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AUTHOR Collier, Richard M.
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ABSTRACT

A study compared written texts produced by hand, by typewriter, and by word processor for differences in improvement in creativity and writing skills. Subjects included six college students--two with high creative ability, two with average creative ability, and two with low or weak ability. During a training period, the subjects were required to become familiar with a selectric typewriter and a word processing unit. During the next stage of the project, the students met each week for six weeks to compose their essays. In the first two weeks they composed their texts by hand, in the second two weeks they wrote on typewriters, and in the last two weeks they composed on the word processors. All the subjects wrote on the same topics and did so in the same sequence. Among the findings were the following: (1) the average creative ability group increased in creativity and the high creative ability group increased its scores in writing skills when they shifted from writing by hand to typing; (2) the strong ability group improved its creativity most with the word processor; (3) the average creativity group was the most creative on the typewriter, next most creative on the word processor, and least creative when writing by hand; (4) the weak creative ability group, like the strong group, displayed little difference in creativity between essays written by hand and on a typewriter emerged; and (5) just as the persuasive essays were assessed to be superior to the expository essays in creativity, so also were they assessed to be superior in writing skills. (Tables of findings accompany the text, and appendixes include a creativity scale and the CUNY test evaluation scales for writing skill assessment.) (HOD)

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THE EFFECTS OF A COMPUTER-BASED TEXT-EDITOR ON THE CREATIVITY AND WRITING SKILLS OF COMMUNITY COLLEGE COMPOSITION STUDENTS: A PILOT PROJECT

by

Richard M. Collier

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CS 208 425

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INTRODUCTION AND BACKGROUND:

Arthur C. Clarke in his most recent novel 2010: Odyssey Two (1982) concludes his page of acknowledgments with the following note:

> This book was written on an Archives III micro-computer with WordStar software and sent from Colombo to New York on one five-inch diskette. Last-minute corrections were transmitted through the Padukka Earth Station and the Indian Ocean Intelsat V.[1]

Here is science fiction written and delivered by what, until recently, would have itself been called science fiction. In fact, even that most conservative bastion of the literary arts, the writing of poetry, appears, if I read Peter A. McWilliams correctly in his recent volume The Word Processing Book, to be influenced by the terminal:

> Why are poets turning to computers in record number? Personal computers, outfitted with a quality word processing program, allow a writer maximum freedom to rearrange, take from, add to, alter, correct -- in a word, change -- the material being written. Of all writers, poets do more rearranging, taking from, adding to, altering, correcting -- in a word, changing -- than anyone else. Hence, the benefits of word processing accrue quickly for poets.[2]

A future inextricably tied to computer technology is, it would seem, hard upon us. For example, one need only scan the ERIC index and related bibliographies to note the increase over the last few years in the number of articles discussing the application of computers just to education. And, yet, however readily most of us might admit that the computer could have relevance to the mathematics or science classroom, we might be harder pressed to see its application to the humanities. Still, such inroads are being made.[3] One of the most promising possibilities, as the examples cited earlier suggest, is in the use of the word processor to assist the teaching of writing. Work in this area is at present still rudimentary and tenative, only a few studies having yet appeared in the literature.[4]

The experts -- those who actually write or who are involved in the publishing industry -- are, nevertheless, almost unanimous in their acclaim for the seemingly mysterious powers of the word processor to help an author compose. William Zinsser, executive editor of the Book-of-the-Month Club, suggests, for example, that "there's almost no limit to the variety of projects that a word processor can help a writer to write . . . ."[5] As well, it may also improve style: "The word processor will help you to achieve three cardinal goals of good writing -- clarity, simplicity and humanity . . . ."[6] These testimonials are implicitly confirmed by a recent survey that noted the wide-spread use of word processors among professionals who are required to write on the job:

> Do you compose on a computer or use a computer for word processing? Just over a quarter of our sample (25.5%) used computers for communicating in writing. Of the 51 persons who used computers for writing, 47 did so frequently.[7]

What we have generally in the literature dealing with the application of the word processor to the composition classroom are predictions for the future, based largely on the personal experience and intuitions of the authors. Here is Mr. Zinsser again:

> Some of them [educators] feel that children would be most helped by word processors in the sixth grade -- at about age twelve -- when they are first being taught to revise what they have written. The fact is that nobody knows; the technology is too new. I only know that far too many children lose as they get older the exuberance that made their younger writing so distinctive and appealing. Any machine that will postpone this process of drying up -- and will let them continue to write with freedom and risk -- is a machine that parents and teachers [italics added] should take seriously.[8]

Not all practicing writers are quite as sanguine. Damon Knight, for example, seems to echo the not atypical anxiety about flesh and blood being replaced by the chill of machinery when he says, "So there you sit, watching your [computerized] typewriter work and waiting to perform your humble task [of writing], feeling like a vestigial organ that has not yet been eliminated by science."[9]

But such an attitude is unusual. Advocates range from the relatively conservative to the millenarian. At one end of the spectrum are those who see word processing for students as an aid to editing. Thomas Franke of Lansing Community College predicts that "many editing skills may be assumed by the computer as future students write . . . "[10]; but even he concludes his article on a somewhat apocalyptic note: "Yet it seems certain that the computer will

change the ways we learn to write, the ways we teach writing, and the ways we do writing."[11] Others suggest that the computer will be of service primarily by reducing the amount of paper shuffling a teacher and her students might typically engage in:

> Student papers are written on a computer. When a student is ready for a paper to be corrected, he or she signals the instructor's computer file, and the paper can be called up from an office or home computer terminal, the paper graded and comments added by the instructor.[12]

And the venerable Edward P.J. Corbett wryly intersects classical rhetoric with his speculations on the possibility of such a technological future:

> I think that before long we will be teaching courses in composition designed especially for the word processing machine, and somebody will write a rhetoric text that deals specifically with the composing of a piece of discourse on the miraculous [italics added] word processing machine. Who will be the Quintillian of the word processor?[13]

At the far end of the spectrum Ruth Mitchell provides a forecast of things to come that is a linear extension of what others claim is already in part taking place:

> An ideal writing classroom for the 80's and 90's would have every student seated at a CRT, connected to every other machine in the room and the instructor's. All could look at one person's paper on their own screens, all could suggest changes, and all could immediately see the effects. If the technology becomes cheap enough, the network could be

> extended to students' homes, so that writing groups could revise and edit each other's work at home in the evening and transmit it directly to the teacher's screen.[14]

This is perhaps testimony enough of change in the educational winds. But before moving on to a discussion of the current project, let us pause to consider briefly why and how a word processor seems to make such a profound and salutary alteration in writing habits, writing process and written product. Siv Cedering, a professional writer, gets at the answer succinctly when she says that

> perfection even more than speed, is the biggest reward of using a word processor. The worst thing a writer can do is not to polish something because of laziness. We don't realize how much time all that housekeeping -- fiddling with paper, erasing, retyping -- takes, and after a while you get so tired of whatever you're working on. A word processor frees a writer from that.[15]

In other words, a text-editor makes more efficient everything that a writer ordinarily has to do: writing and revising are faster, less time is wasted in peripheral activity when creating or altering a text, and memory as well as cognitive processes are freed up by the storage capacity of the computer.

Colette A. Daiute puts this excellently:

> The physical act of writing is slow and sometimes painful, and revising requires tedious recopying. Psychological factors such as limits on memory add to these physical barriers. One pyschological constraint is the limitation

> of short-term memory, which burdens writers as they carry on the complex mental activities of composing and revising.[16]

In addition, she mentions the advantage of postponement so that the writer is no longer required to perform a multitude of complex tasks simultaneously: "People do not grow as writers unless they take risks and make changes in their texts, but it is hard to take the risk of changing the organization of a paper or deleting part of a sentence, when it is necessary to recopy the entire piece before evaluating the changes."[17] Consequently, "knowing that there will eventually be an automatic aid in focusing on errors helps free writers to postpone the evaluation process, so that they can concentrate on one activity at a time."[18] Therefore, "writers are not tyrannized by tiresome, unsatisfying tasks"[19] and ". . . free themselves for thinking."[20]

She does add one warning, however, a warning to which I will return briefly later in this paper: "The computer can, nevertheless, add to the complications of writing if the user's training is not adequate or the system is too complex."[21]

If in fact these various assertions concerning the beneficial effects of composing with a word processor are correct, one should notice improvements not only in the speed with which students can produce text, but also in the quality of those texts. Texts produced on a word processor should be better than those produced by the time-honored method of writing by hand. But what, indeed, do we mean by "better"? What can we look to have happen when student writers ". . . free themselves for thinking"?

For the purposes of the present study I defined this "betterness" as improvements in creativity[22] and in writing skills. The study, therefore, attempts to measure the differences in these two dimensions for written texts produced in three separate manners: by hand, by typewriter, and by word processor. Composing by typewriter was added into the project for two reasons. First, writing on a typewriter is clearly intermediate between writing by hand and writing on a word processor; it is mechanical, but more familiar and less complex for most students than a word processor. Second, if the typewriter helped produce texts superior to those written by hand and equal or better than those written on a word processor, it could be argued that typewriters, being cheaper, should be part of the composition classroom rather than the more expensive word processors.

At least two caveats are in order at this point, the first rather specific and the second more general. Teachers, rhetoricians, writers and psychologists might all object that it is impossible to measure either writing skills or creativity. And perhaps rightly so. It is doubtful if consensus could be achieved among the experts about matters so elusive, mysterious and subject to the vagaries of personal taste as what makes for excellent writing skills. We could be certain of even less success when it comes to defining and characterizing creativity. Nevertheless, an inability to map these concepts in quantifiable, verifiable and replicable terms need not deter us from attempting to make approximations. Such measurements may be subject to error and inexactness, but they may still be capable of illustrating large changes, strong dispositions and major tendencies. They provide a new window through which a cluster of phenomena can be observed, but a window which is, in effect,

slightly opaque. In fact, the observational windows in the social sciences will probably never be as clear as those in physics or biology.

Even though we may justify the study of such problematic concerns as writing skills and creativity in this manner, it still behooves us to minimize as much as possible the opacity of our windows. Thus I chose to measure both writing skills and creativity by means of holistic-impressionistic scales using a relatively large group of evaluators who were already familiar with assessing writing, who practiced at length with these scales, and who eventually achieved a fairly high interrater reliability score.

The second caveat is, as mentioned earlier, more general and potentially more damaging for a study such as this. The difficulty derives from the current worship of the methodology of the "hard" sciences, such as astronomy, chemistry and physics. In these disciplines, despite the warnings of quantum mechanics that the observer and the observed are interlinked, that observation may ineluctably alter that which is observed, and that unexplainable irrationalities in the very small and very large may exist, the scientific method reigns absolute. In its most general sense the scientific method means experiment, measurement, quantification, prediction, and the like. What cuts through all of this is, of course, numbers -- things that can be counted. Unfortunately, as we move from the inorganic sciences to the organic, matters become considerably more enigmatic and quantification somewhat less reliable. Geology and biology are still sciences in which measurement is queen, but the measurements are often less accurate and less trustworthy -- at least as predictors -- than in physics and astronomy. Organic molecules seem somehow to "contaminate" quantifiable observations with mystery.

Matters are even worse when dealing with groups of organic molecules possessing consciousness and intelligence: the social sciences are notorious for accumulating vast oceans of data, much of which is worthless either as assessment or for prediction. Sociology, psychology, linguistics and the like strain their credibility when they attempt to adapt the empirical methodology of the hard sciences to their subject matter of human beings and human activity. Nevertheless, quantification and objectivity persist as the modus operandi for the disciplines that examine cognition.

Rhetoric and the study of writing suffer greatly this contradiction: on the one hand, to be purely observational is to risk the accusation of being unscientific and thus without validity (or funding!); on the other, to impose the methodology of the social sciences is to risk specious quantification. Michael Holzman has put this conflict rather succinctly:

> Despite these possible advantages from specialization toward the social sciences, there is a danger at this stage that research will appear which is scientific only in form, lacking both the traditional virtues of humanism and those novel advantages sought from science. Such research, scientistic rather scientific, is the "sympathetic magic" of the humanities.[23]

Thus it would appear that numeration is akin to numerology and the presence of charts, graphs and tables makes a study suspect: "To be guided only by the quantifiable in the choice of measures, especially to be guided by the apparently easily quantifiable, is an error in the transfer of methodologies

from the natural to the social and human sciences,"[24] leading, as Robert J. Connors suggests, "only to a blindered pseudo-certainty."[25]

How are we to overcome this apparently irreconcilable contradiction between the demand for empirical rigor, which calls for quantification, and the recondite complexity of writing, which makes empiricism almost inapplicable? One solution has been descriptive case studies, such as Janet Emig's The Composing Processes of Twelfth-Graders, Sondra Perl's "Five Writers Writing: Case Studies of the Composing Processes of Unskilled College Writers", and Nancy I. Sommers', "Revision Strategies of Student Writers and Experienced Adult Writers." The descriptive case study, instead of attempting as the empirical study does to produce a vast quantity of data drawn from the observation of a large number of subjects and controls, examines in minute detail the activities of a very few subjects. This method has been quite successful in producing valuable conclusions and speculations, but at the same time in selecting this approach "the researcher . . . make[s] a trade-off, foregoing generalizability for the richness of the data and the qualitative insights to be gained from it."[26]

I have attempted in this study to combine the best aspects of the two approaches so as to produce both statistical information[27] and descriptive assessment. In other words, I selected just enough subjects and evaluators to allow my quantification to possess some credibility, but not so many as to prevent the possibility of close scrutiny of individuals. Whether this hybrid is more or less successful than the other two methods remains, of course, to be seen, especially since, as Cooper and Odell remind us, all research in composing by its very nature "is tentative, subject to continual revision."[28]

Nevertheless, this approach has, I think, provided a new window through which fascinatingly unexplored territory can be glimpsed.

METHODOLOGY:

The project possessed five fairly distinct stages: selection, training, writing, evaluation, and analysis.

The first stage, selection, consisted of recruiting the student subjects who would do the actual writing and of discovering a group of experienced evaluators. Invitations to participate in the project were sent to students in several introductory and advanced composition classes. Applicants had to agree to finish the project once they began and had to be able to type quickly and accurately. A fairly large group of applicants was screened by administering a battery of tests ranging from the College Entrance Placement Test (CEPT), which evaluates several writing skills, to instruments that assess style, organizing ability and interpretive ability. As well, the applicants were given a thorough values inventory questionnaire and the Princeton Creativity Assessment Test. From these tests emerged relatively complete and accurate profiles of the applicants' writing skills and levels of creative development.

Eventually, six subjects were chosen: two had high creative ability, two average creative ability and two low or weak ability. To guard against the possibility of sex-linked bias each group was composed of one male and one female subject.

Simultaneously, I sent to many of my colleagues invitations to participate in this project as evaluators. Again, I had several applicants, and, again, both for parity with the student subjects and in order to insure the validity

and consistency of mathematical assessment, I settled on a group of six. To counteract possible sex-linked bias the group of evaluators was composed equally of men and women. However, in order to study possible discipline-linked bias, I selected four evaluators from the English Department and two from the sciences (biology and economics).

Earlier, I had begun developing the creativity scale, each draft of which was submitted to several colleagues for suggestion and comment. After many revisions, a version was prepared that functioned accurately as a means of sorting written essays into a hierarchy of six separate creativity categories (see Appendix A).

During the training period the subjects were required to become familiar with two kinds of equipment: self-correcting, Selectric II typewriters and stand-alone Micom 3004 word processing units, using dual density Micom diskettes #13850 D01, and attached Tec printers. These Micom terminals possess one of the simplest, most accurate and "user-friendly" command systems available. Sufficient time was devoted to teaching the students the keyboard commands and to drill and practice that each became a quite proficient operator. In other words, by the time they started to write on the word processor the subjects could concentrate on what they wanted to say and how they wanted to say it without keyboarding interference. My intention was, of course, to nullify Daiute's objection that inadequate training or too complex a system might hinder the composing process.

At the same time, the evaluators were given copies of a slightly altered CUNY scale for assessing writing skills (see Appendix B) and of the Creativity

scale, and were asked to become thoroughly acquainted with the terminology and categories. Eventually, all six were requested to evaluate a large group of essays, which had been carefully assessed for writing skills and creativity. The results of this practice session showed 85% agreement amongst the evaluators and with the original rankings.

During the third stage the student subjects met each week for six weeks to compose their essays. In the first two weeks they composed their texts by hand, in the second two weeks they wrote on typewriters, and in the last two weeks they composed on the Micom word processors. All the subjects wrote on the same topics and did so in the same sequence. Each topic was uniformly brief, a single word or short phrase, and the students were instructed to use that word or phrase as a springboard for their writing; it was, in other words, a starting point, not a boundary. The topics were designed so that half would elicit expository essays and half persuasive essays. The topics were divided equally amongst the three modes of composing: each subject wrote one expository essay by hand, one on the typewriter and one on the word processor; the same sequence obtained for the persuasive essays. Expository topics were used twice to stimulate the first essays in a set and the persuasive topics were used once to stimulate the first essay. The students were allowed to use paper and pen at the beginning of each session for notes, heuristics, doodling, and the like. Although they were permitted to smoke, drink coffee, and take short breaks, they were all required to compose in the same environment and refrain from talking to each other. They were asked to write at least two but no more than three hours.

At the end of the six-week writing session, each subject wrote an extensive evaluation of his or her experiences during that period, focusing particularly on impressions of and attitudes toward writing on the word processor in comparison with the other two modes of composing.

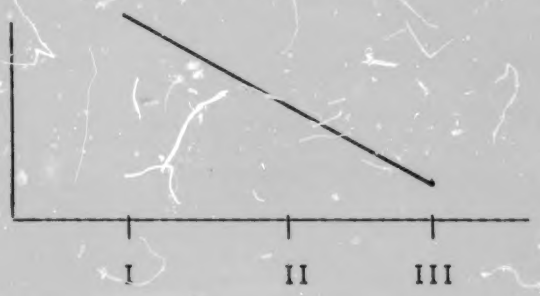
When the writing session was completed, I retyped the essays so that format and appearance were nearly identical for all thirty-six (this was, of course, of importance primarily for the handwritten essays), and so that each would be anonymous. I then shuffled the essays to eliminate sequences in mode of composition, type of essay, or author, and coded them. Packets of these essays, notes highlighting the steps in the evaluation process and a scoring chart were subsequently sent to the evaluators.

After the student evaluations and the scoring charts were returned, I began my descriptive and statistical assessment. Several notes of clarification in this regard are warranted here:

1. Distribution comparisons refer to the division of the spectrum of scores into halves and thirds: a predominance of scores from one mode of composing in the upper third and even in the upper half would be a strong indicator of a preference for that mode of composing. Norms were determined by dividing the number of units between the maximum and minimum scores into halves or thirds. Averages divided the scoring spectrum according to the number of samples. The average in this project, for example, would always include twelve samples in each third, whereas the norm might include in the upper third only four or five scores, in the middle third twenty-six scores, and in the lower third nine or ten scores. The average or median assessments were usually more reliable than norm assessments.

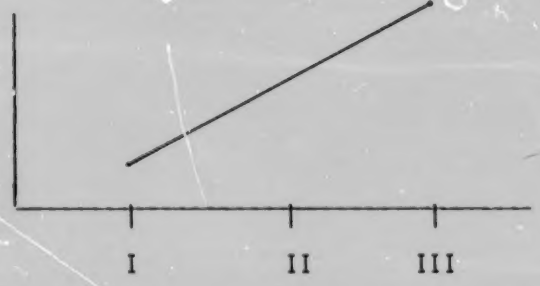
2. In most of the graphs the curves for distribution comparisons will approximate one or the other of five possible configurations. In the examples which follow the ordinate records the number of essays and the abcissa the terciles, the first being the top third, the second the middle third, and the third the lowest third.

I. Best curve:



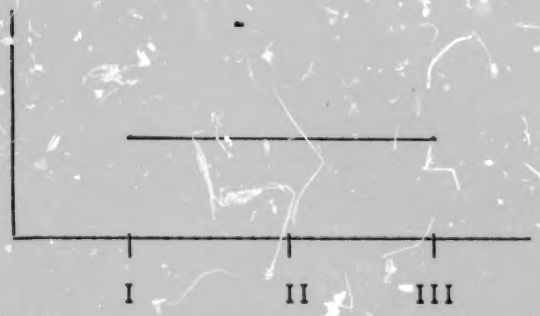
There are many scores in the first tercile, a few in the second, and almost none in the third; the greater the angle with the abcissa the more ideal the curve.

II. Worst curve:



There are many scores in the third tercile, a few in the second, and almost none in the first; the greater the angle with the abscissa the less ideal the curve.

III. Neutral curve:

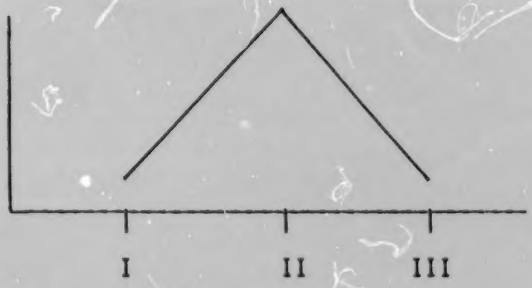


Each tercile has an equal number of scores; strong, average and weak are undifferentiated.

IV. Unreliable curve:

A score is equally likely to be in either the top or bottom tercile; this is a curve of polarity: whatever is being tested is very good for some, very weak for others, and possesses little middle ground.

V. Bell curve:



There are equally few scores in the top or bottom terciles; more scores are clustered in the middle (often the mediocre) tercile.

3. The following abbreviations may be used from time to time in this report:

α = essays written by hand

β = essays written on a typewriter

γ = essays written on a word processor

M = male writer

F = female writer

H = high (strong) creative ability group

Md = mid (average) creative ability group

L = low (weak) creative ability group

P = persuasive essay

Ex = expository essay

Hum = humanities evaluators

Sc = science evaluators

4. The subjects were coded by letter, and were identified by the following characteristics: A = F, Md; B = F, L; C = M, H; D = M, Md; E = M, L; F = F, H.

HYPOTHESES AND RESULTS:

This section presents eighteen hypotheses, the experimental results, the statistical analysis, observations, charts and graphs. Unbracketed numbers are unadjusted or raw scores and percentages; bracketed numbers refer to scores and percentages adjusted statistically for slight abberations in the original evaluations. Appendix C is a table that condenses and summarizes the results.

I. Hypothesis: The subjects' scores collectively for creativity will be highest for essays written on the word processor, next highest for essays written on the typewriter, and lowest for those composed by hand.

Results: 1. Distribution comparisons indicate that essays written by hand had the lowest creativity scores of the three sets of essays for four of the six subjects; for none of the six subjects did the essays written by hand receive highest creativity scores. Analysis of the norms shows more scores of essays written by hand in both the lower half and the lower third of the spectrum than scores for essays written either on a typewriter or a word processor; analysis of averages (medians) shows slightly more scores for essays written by hand than scores for essays written by typewriter, and more scores for essays written on a typewriter than scores for essays written on a word processor in the lower third of the spectrum.

2. Typing produced essays which were generally more creative than those composed by hand: +4.7%. Four subjects improved their creativity scores when typing their essays as opposed to writing them by hand (A: +2.38%; B: +14.29%; C: +15.56%; D: +17.50%), while two had scores that declined, but only slightly (E: -7.50%; F: -8.93%). Essays written on a typewriter received scores that were, according to normative analyses, two and one-half times as likely to be in the upper half of the spectrum as scores of essays written by hand; most of the typing scores, however, are clustered in the middle third (twice that of essays written by hand).

3. Word processing produced essays somewhat more creative than those composed by typing: +5.6%. However, there were an equal number of subjects

who increased their creativity scores as decreased: A: +13.94%; E: +29.73%; F: +15.69%; B: -5.00%; C: -1.92%; D: -14.50%.

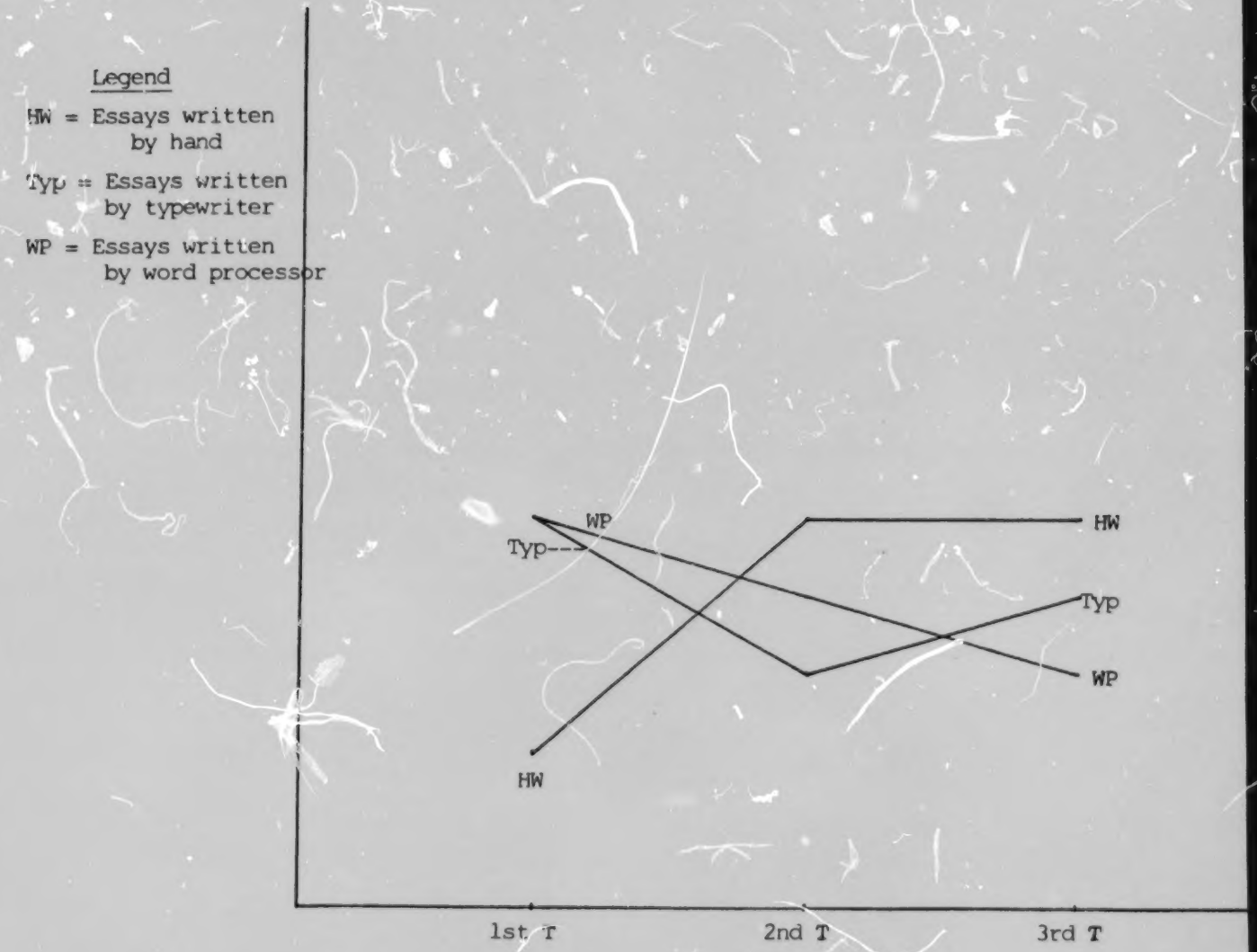
Interestingly, those subjects whose creativity increased when composing on a typewriter as opposed to writing by hand declined in creativity scores when using a word processor, whereas those whose creativity decreased when typing as opposed to writing by hand showed improvements when writing on a word processor.

4. Word processing seems generally to produce essays that are more creative than those composed by hand (+10.5%). Five subjects improved their creativity scores when using a word processor as compared to writing by hand: A: +16.67%; B: +8.57%; C: +13.33%; E: +20.00%; F: +5.36%. One subject (D) had scores for both modes of composing that were nearly identical.

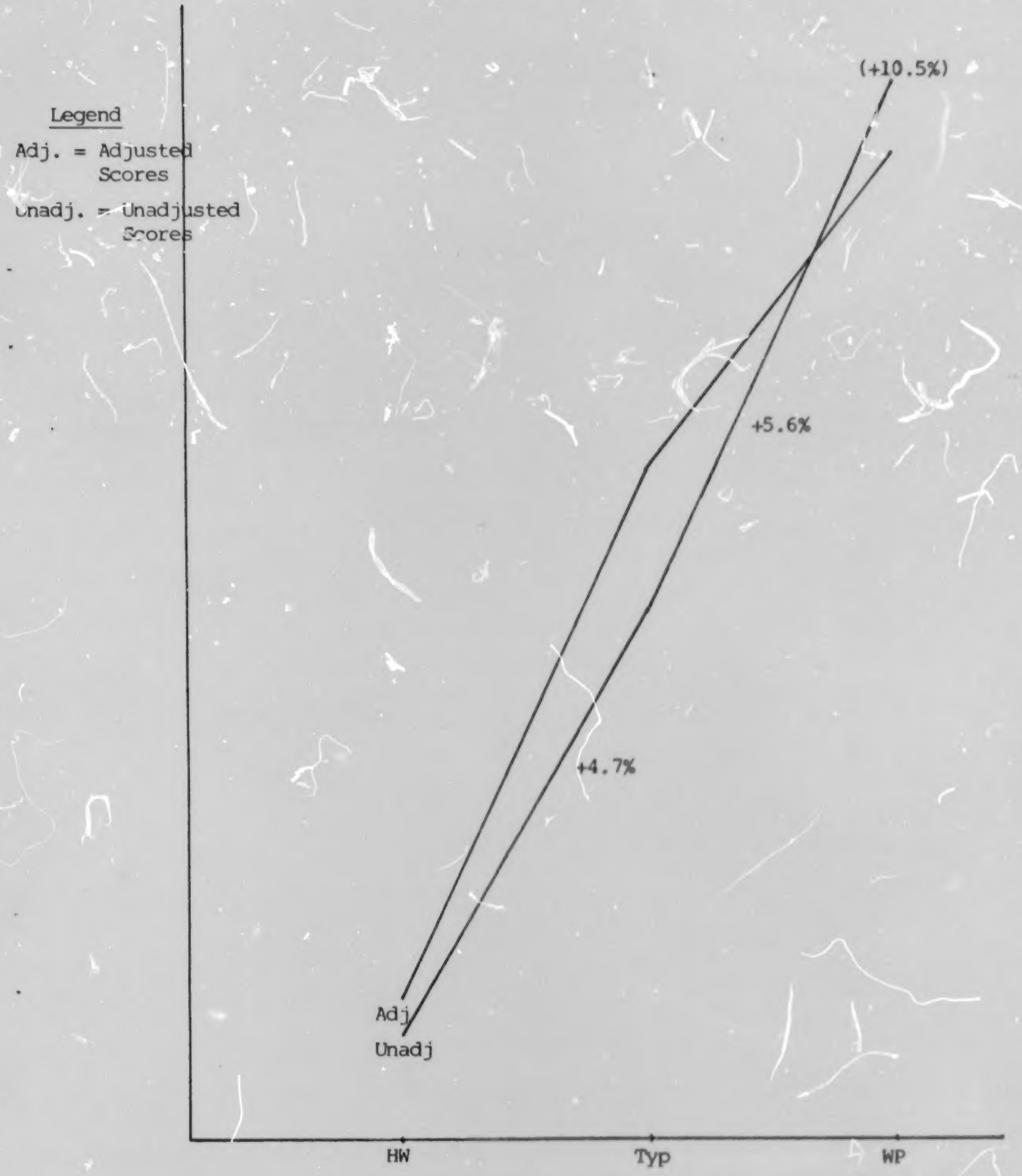
Normative analysis indicates as great as three and one half times as many word processing scores in the upper half of the spectrum as scores for essays written by hand, and a median analysis shows the ratio to be three to one. In fact, most of the word processing scores are concentrated in the upper third -- there are two and one half times the number of word processing scores here as there are handwriting scores.

5. Graph I (median analysis) shows handwritten essays to approximate the Worst Curve, typed essays to approximate the Unreliable Curve, and essays composed on the word processor to approximate the Best Curve. Graph II reveals that for both unadjusted and adjusted scores there is a linear increase in creativity from handwriting to typing to word processing.

CREATIVITY: Distribution of Scores by Tercile
(Graph I)



CREATIVITY TOTALS
(Graph II)



Graph III shows that for two subjects (E, F) typing produced the worst creativity scores and word processing the best; for one subject (A) the creativity for typed essays was slightly higher than for handwritten essays, and essays produced on a word processor were creatively superior to those written by the other two modes of composing; for three subjects (B, C, D) typing produced the most creative essays, although for two (B, C) word processing was not far behind; for only one subject (D) was word processing equal in creativity to handwriting. For none of the subjects are creativity scores for pairs of essays for word processing lower than their scores for handwriting, and the increases in creativity for word processing for three of the subjects were so great as to offset the slight decline in creativity for word processing as compared to typing for the others.

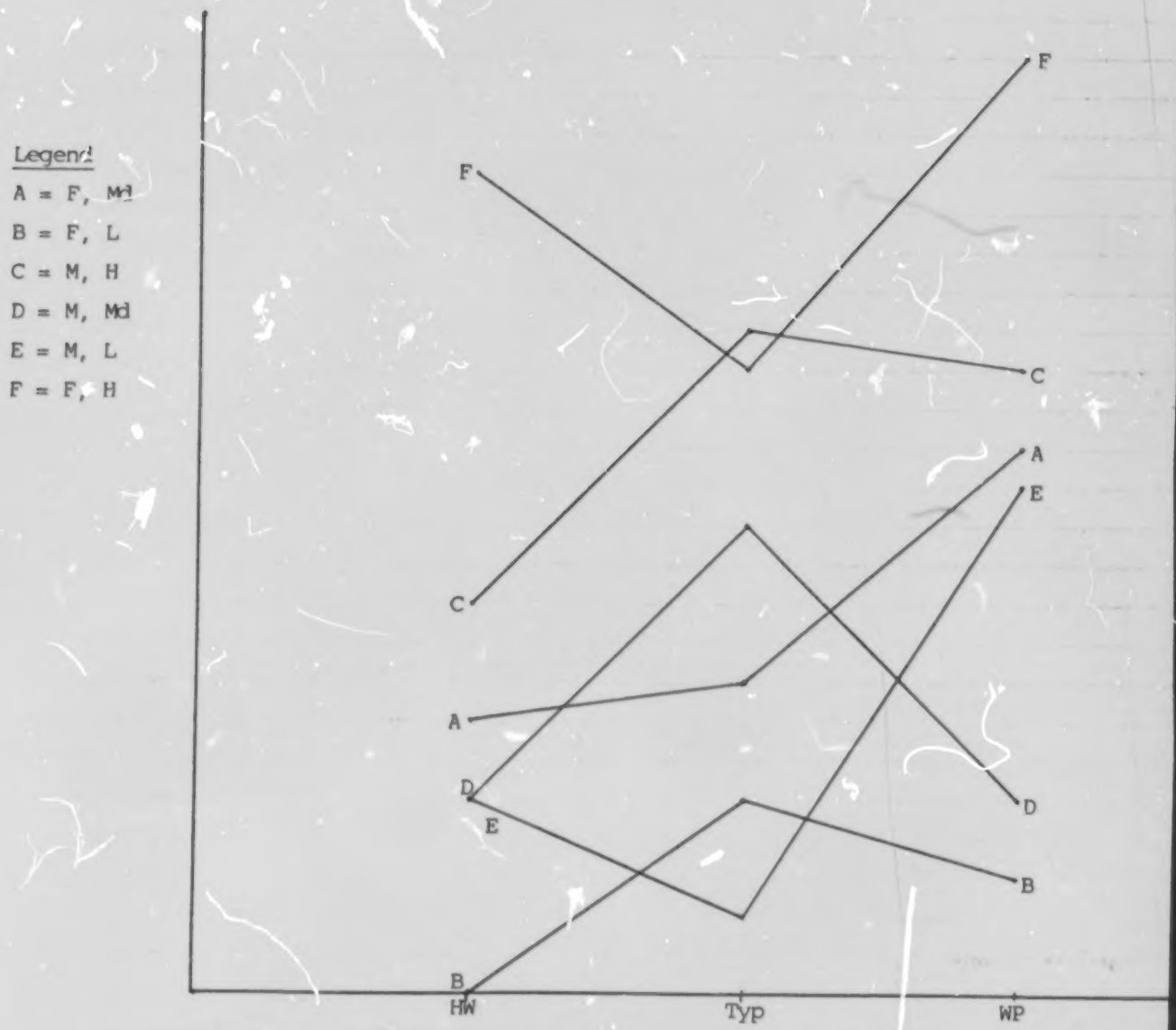
II. Hypothesis: The subjects' scores collectively for writing skills will be highest for essays written on the word processor, next highest for essays written on the typewriter, and lowest for those composed by hand.

Results: 1. Normative analysis shows typing scores for writing skills to be equally distributed across the spectrum (equal numbers of scores in each half and third); however, handwriting scores are not equally distributed: there are few handwriting scores in the upper half and many in the lower half by a ratio of two to one. Median analysis essentially confirms the normative analysis: handwriting has fewest scores in the upper half and the upper third, and most in the lower half and the lower third (a ratio of two or three to one); the greatest number of typing scores occurs in the middle third.

2. However, writing skills in essays produced on a typewriter were frequently inferior to those found in essays written by hand, and the total

CREATIVITY: Distribution of Scores by Subject

(Graph III)



score declined from that of handwriting by (-)2.6%. Althougn two subjects improved their scores in writing skills when typing their essays as opposed to writing them by hand (B: +4.65%; C: +20.00%), four had scores that declined from the one to the other (A: -4.44%; D: -2.50%; E: -26.09%; F: -5.08%).

3. Composing on a word processor produced better writing skills for the most part than composing on a typewriter: +7.2%. Writing skills improved for four of six subjects when they switched from typing to word processing (A: +18.36%; B: +4.44%; C: +2.13%; E: +32.35%), while in only two cases was there a slight decline (D: -2.56%; F: -3.57%). Normative and median analyses show a high concentration of word processing scores for writing skills in the upper half and considerably fewer scores in the lower half by a ratio of about two to one. Similarly, the upper third contains two times the word processing scores of the lower third.

4. Word processing seems generally to produce essays slightly superior in writing skills to those composed by hand (+4.5%), although only three subjects improved their writing skills scores when using a word processor as opposed to writing by hand (A: +13.33%; B: +9.30%; C: +26.32%); the declines, however, were relatively slight (D: -5.00%; F: -8.47%; E: -2.17%).

Normative and median analyses show three times as many word processing scores in the upper third of the scoring spectrum than there are handwriting scores, and six times the handwriting scores in the lower third than word processing scores; it is three times more likely to find a handwriting score in the lower third than in the upper, and seven times more likely to find a word processing score in the upper third than in the lower; therefore, it is less likely for handwriting to produce poor writing skills than it is for word processing to produce good writing skills. In effect, word processing nearly

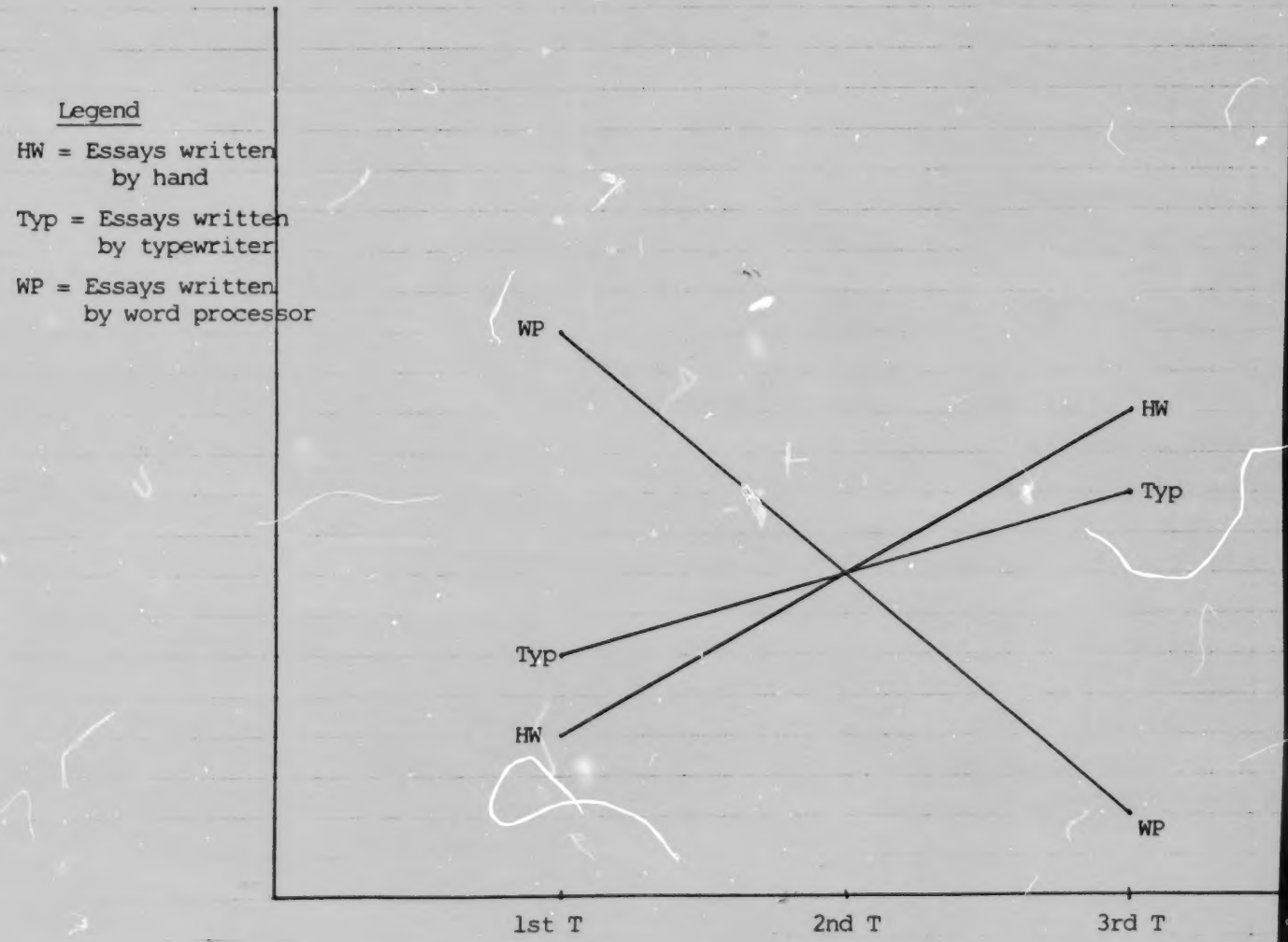
always produce writing skills superior to those found in the essays composed by either typing or handwriting.

Graph IV (median analysis) shows that for writing skills the scores for essays composed on the word processor approximate the Best Curve; scores for both typed and handwritten essays approximate the Worst Curve, with scores for handwritten essays possessing the steepest (worst) angle. Graph V of the CUNY totals reveals that for both unadjusted and adjusted scores writing skills are worse for typed essays than for either handwritten or word processed essays, whereas word processed essays are superior in writing skills to the essays composed by the other two modes. Graph VI shows that writing skills appear to decline from handwriting to typing for four of the six subjects (A, D, E, F) and to increase for two (B, C). Word processing scores for writing skills are higher than those for the other two modes of composing for three subjects (A, B, C), higher than typing but not handwriting for one (E), higher than handwriting but not typing for none, lower for typing but not handwriting for none, and lower than either handwriting or typing (but only slightly) for two (D, F).

III. Hypothesis: Creativity scores for men will be highest for essays written on the word processor, next highest for essays written on the typewriter, and lowest for those composed by hand; creativity scores for women will be highest for essays written on the word processor, next highest for essays written on the typewriter, and lowest for those composed by hand; there will be no significant difference in creativity scores between the men and women in each of the modes of composing.

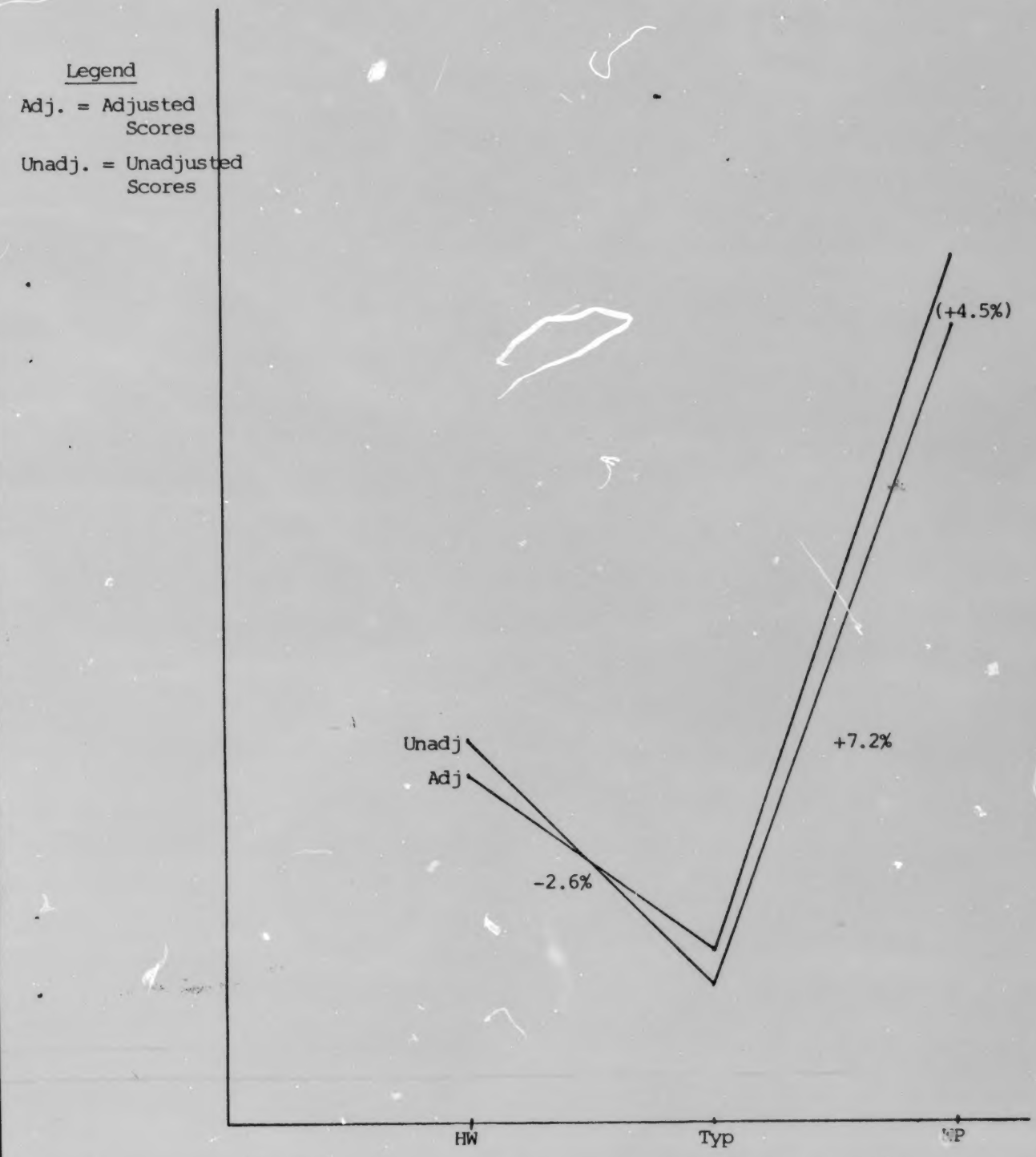
WRITING SKILLS: Distribution of Scores by Tercile

(Graph IV)



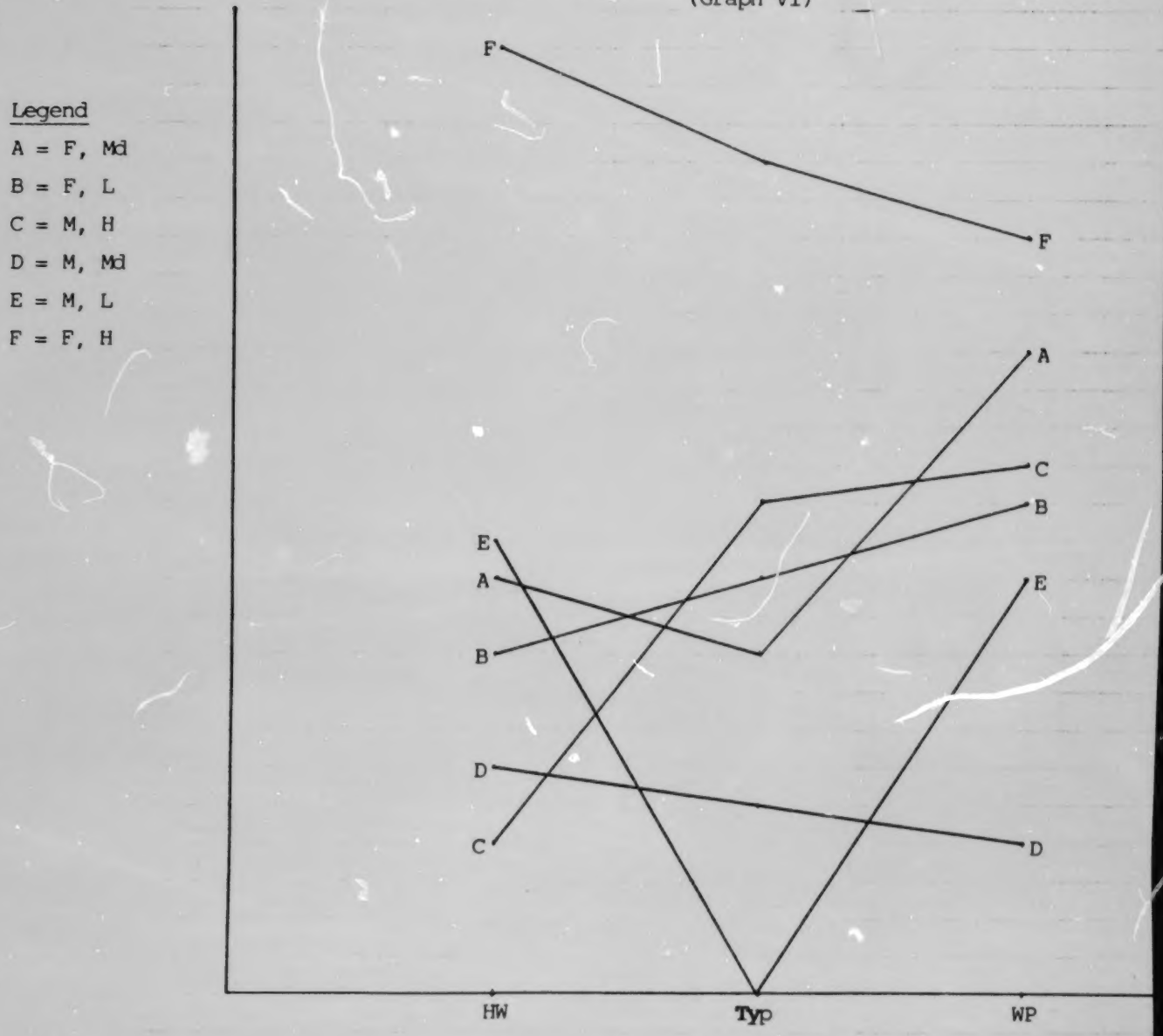
WRITING SKILLS TOTALS

(Graph V)



WRITING SKILLS: Distribution of Scores by Subject

(Graph VI)



Results: 1. The men wrote essays by typewriter that were evaluated to be +8.8% more creative than the essays written by hand. The creativity scores for essays written by the men on a word processor did not differ significantly from those awarded to essays written on a typewriter (+2.2%). Thus, the improvement for men in creativity scores for essays written on a word processor as opposed to essays written by hand is about the same (+11.00%) as the improvement of typing over handwriting.

Most of the handwritten essays by the men received low scores and never high scores; interestingly, the men received almost no low scores for their essays composed on a typewriter.

2. The women improved very slightly their creativity scores when switching from writing by hand to typing (+0.75%). The creativity of the women composing on word processors was, however, evaluated to be +9.00% improved over the creativity exhibited by the essays written on a typewriter. Thus the women increased their creativity from handwritten essays to essays composed on a word processor by +9.8%.

Most of the handwritten essays by the women received low scores and never high scores. As well, the women had several essays produced by typing receive low scores.

In general, the women were most creative on the word processor and least so when writing by hand; the men were most creative on the typewriter, followed closely by the word processor, and least creative when writing by hand.

3. The women were slightly superior to the men in creativity for essays written by hand (+6.40%). However, the men had twice as many high scores for

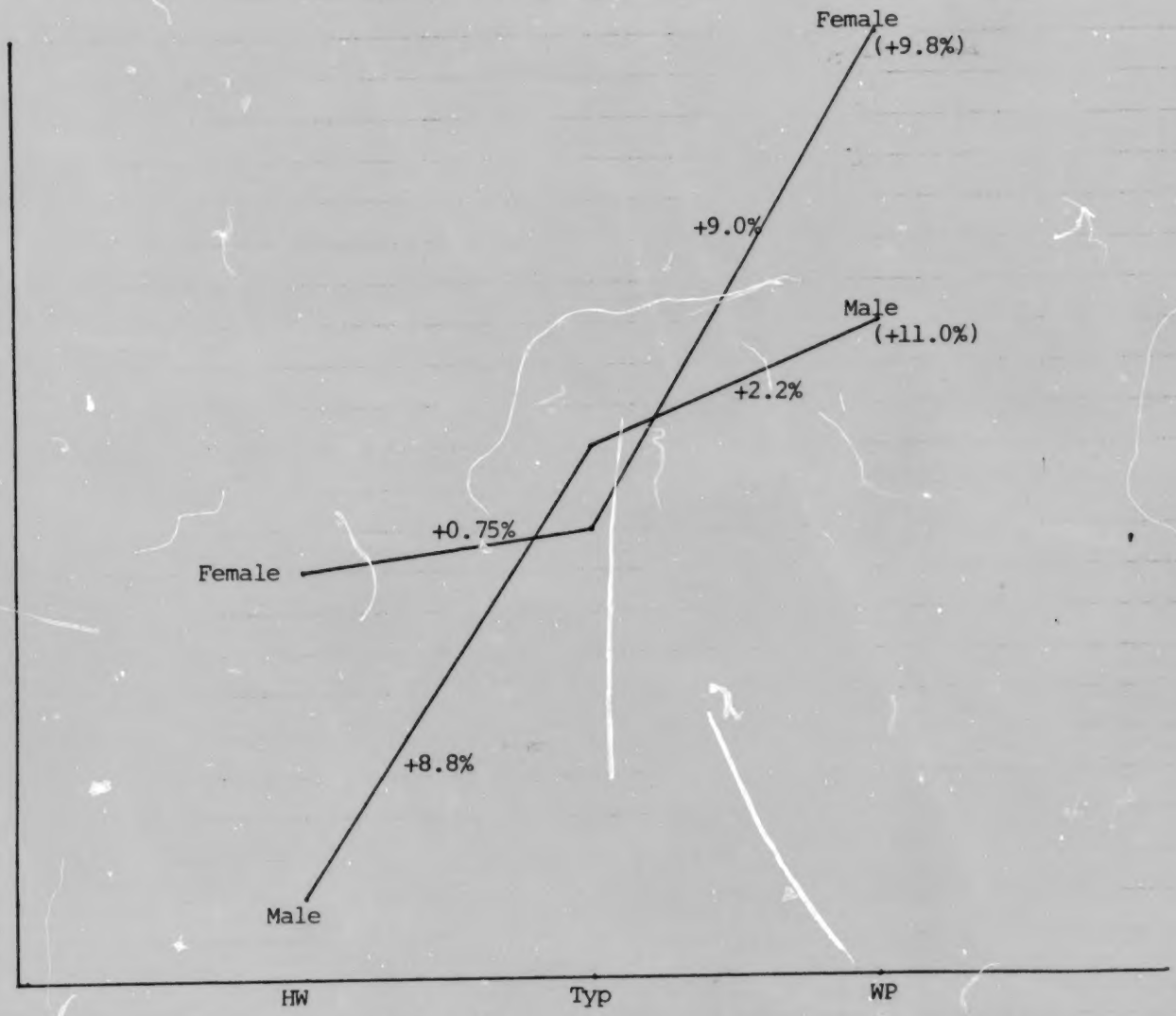
typed essays than the women, and were, therefore, slightly more creative than the women when writing on a typewriter. Clearly, then, the men made greater creativity gains than the women when shifting from writing by hand to writing by typewriter.

The women received no low scores for essays written by word processor, and received three times as many high scores as the men for essays written by word processor. The women were +4.8% more creative than the men when composing on the word processor, which indicates a slight overall relative increase in creativity for the men as compared to the women of 1.6 percentage points. The women, however, made greater gains in creativity than the men when shifting from writing by typewriter to writing by word processor.

4. Graph VII shows that the women started with higher creativity scores than the men on essays written by hand. Both the men and women increased their creativity when composing on a typewriter as compared to writing by hand (the women only slightly); interestingly, the men were considerably more creative than the women in this mode. Composing by word processor produced significantly more creative essays for the women than either typing or writing by hand; the men also increased their creativity when composing by word processor, but not nearly as much as the women. Graph VIII shows the relative differentiation for creativity of the composing curves for the men and women by collapsing the origins to a common point.

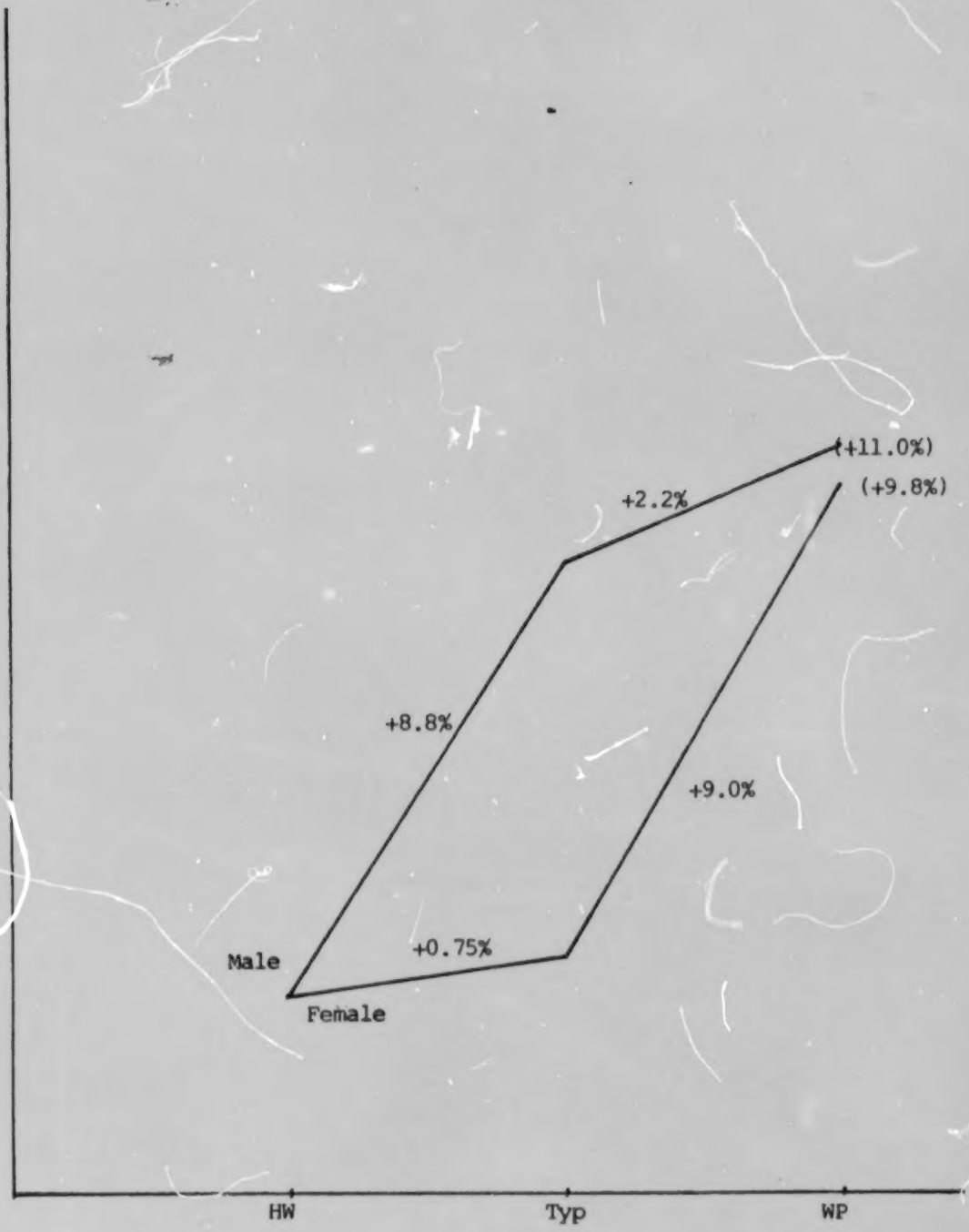
CREATIVITY: Sex Differences

(Graph VII)



CREATIVITY: Sex Differences (Collapsed Origins)

(Graph VIII)



IV. Hypothesis: Scores for writing skills for men will be highest for essays written on the word processor, next highest for essays written on the typewriter, and lowest for those composed by hand; scores for writing skills for women will be highest for essays written on the word processor, next highest for essays written on the typewriter, and lowest for those composed by hand; there will be no significant difference in scores for writing skills between the men and women in each of the modes of composing.

Results: 1. The men showed a slight decline in scores for writing skills when composing by typewriter as compared with scores received on essays written by hand (-3.2%), but improved their scores for writing skills when using a word processor to compose as compared to using a typewriter (+9.2%) and as compared to writing by hand (+6.0%). Distribution comparisons suggest that each mode of composing was equally likely to produce essays receiving low scores, but that word processing was most likely to produce essays with high scores.

2. The women showed a slight decline in scores for writing skills when composing by typewriter as compared with scores received on essays written by hand (-2.0%), but improved their scores for writing skills when using a word processor to compose as compared to using a typewriter (+5.4%) and as compared to writing by hand (+3.4%). Distribution comparisons suggest that each mode of composing was equally likely to produce essays receiving low scores, but that word processing was most likely to produce essays with high scores.

3. The women had a significant superiority to men in writing skills for essays written by hand (+18.5%) and for essays composed on typewriters (+20.0%). In fact, the superiority of writing skills for the women established

for essays written by hand is increased slightly (1.5 percentage points) when the mode of composing is changed to typing, even though for both sexes scores for writing skills declined for essays written by this mode.

The women also maintained their margin of superiority in scores for writing skills when both groups composed on word processors (+16.0%), although there was a slight decline from handwriting (2.5 percentage points) and from typing (4.0 percentage points).

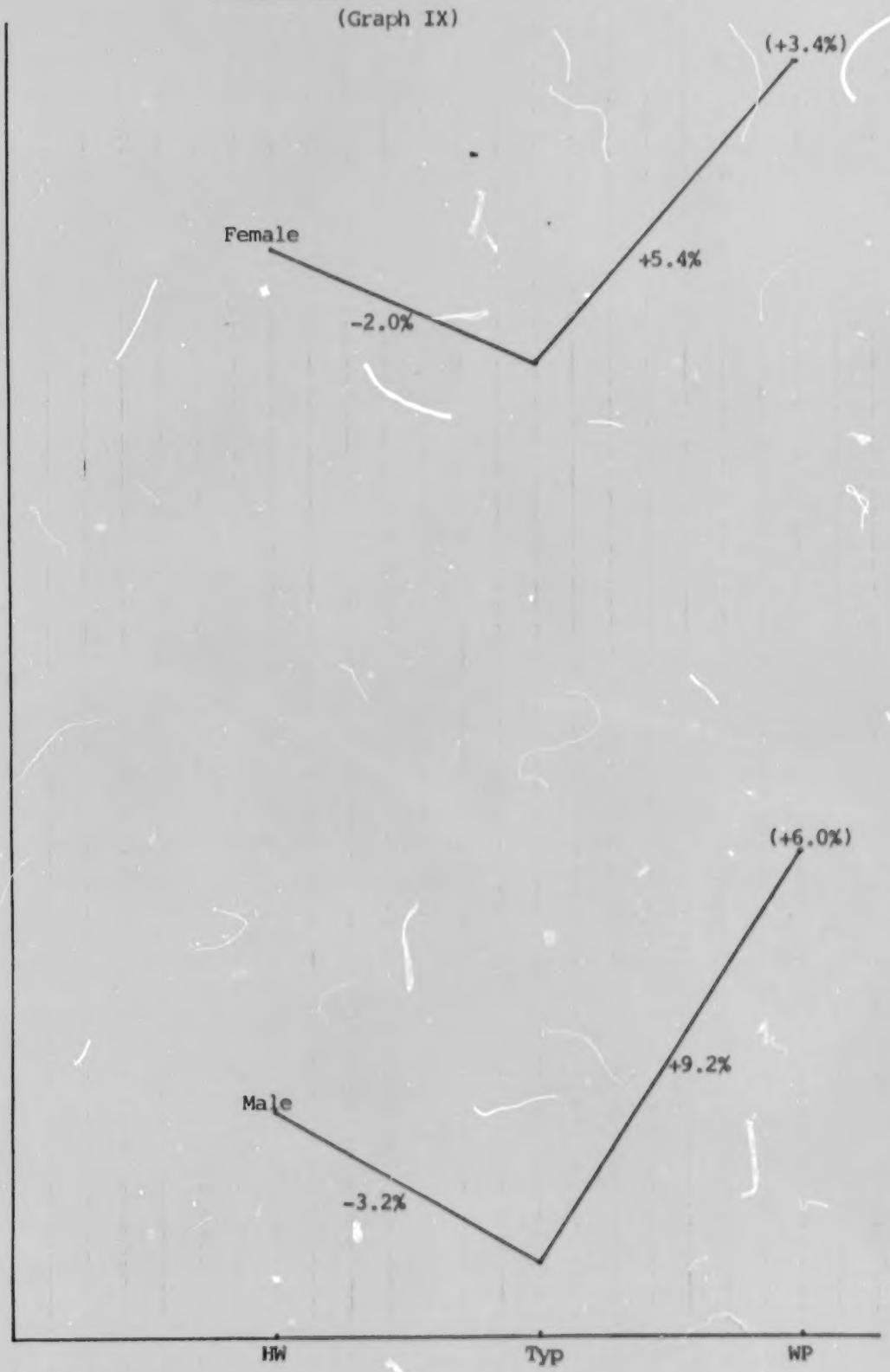
4. Graph IX shows this significant superiority in writing skills of the women over the men. However, both the men and the women declined in writing skills from handwritten essays to typed essays (the women slightly less than the men), and both increased quite considerably when essays were composed on a word processor. Graph X shows the relative differentiation for writing skills of the composing curves for the men and women by collapsing the origins to a common point.

V. Hypothesis: Creativity scores for each ability group (strong, average, and weak) will be highest for essays written on the word processor, next highest for essays written on a typewriter, and lowest for those composed by hand.

Note: Three groups of subjects, each with one male and one female member, were established at the outset of the project on the basis of extensive preliminary testing; these groups were categorized initially as either strong in creativity, average in creativity or weak in creativity. As well, there is an upper maximum bound on evaluator scoring (no pair of essays could, for example, receive a score higher than 72: 2 essays X 6 evaluators X 6 maximum score); consequently, it is considerably more difficult for a group receiving

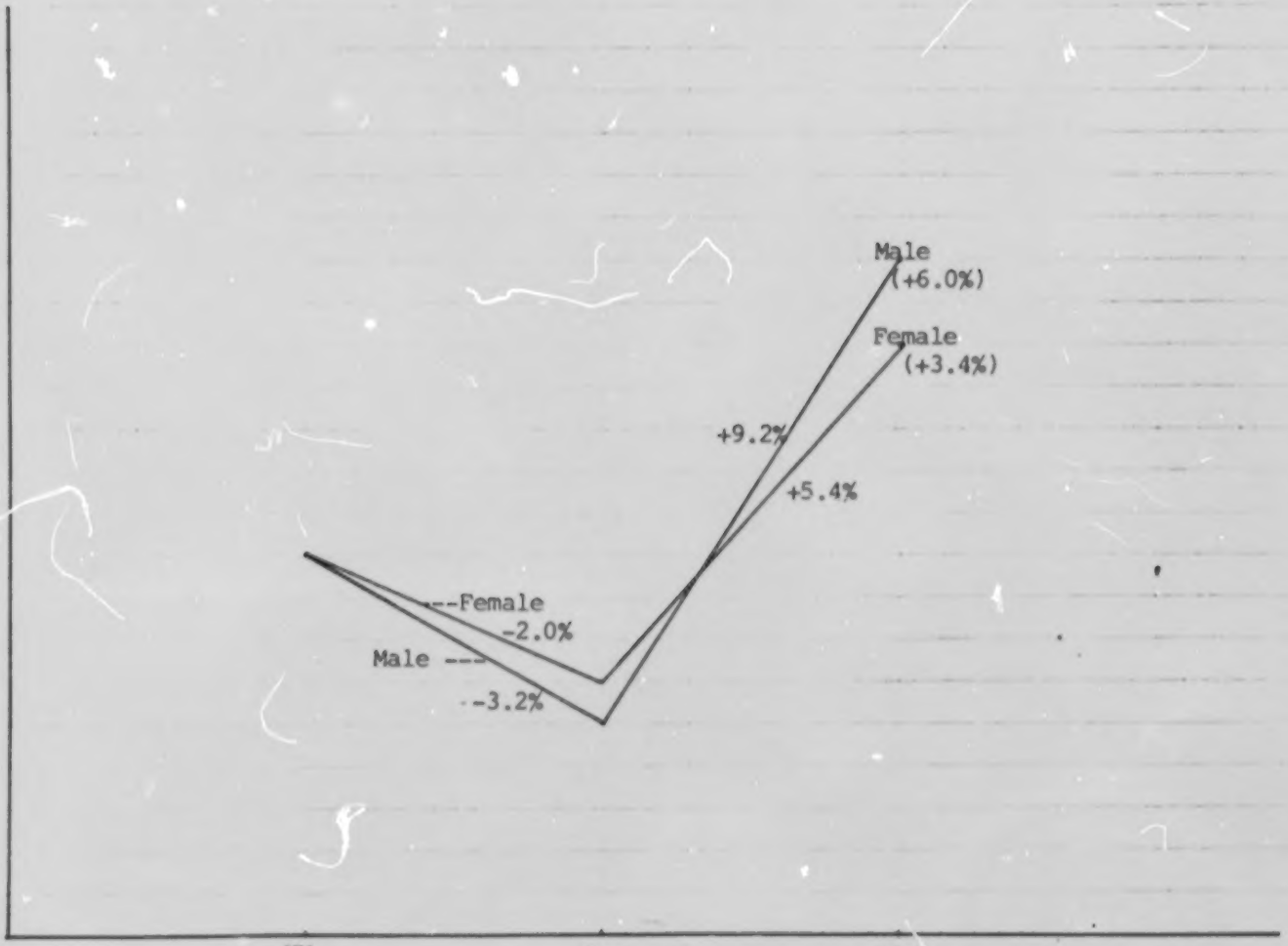
WRITING SKILLS: Sex Differences

(Graph IX)



WRITING SKILLS: Sex Differences (Collapsed Origins)

(Graph X)



quite high scores for handwritten essays to improve markedly during the subsequent sessions employing different modes of composing.

Results: 1. As one might expect from the initial testing, the strong creative ability group consistently achieved creativity scores a good deal above the norm for all three modes of composing. This group's lowest above norm creativity score was achieved for essays written on a typewriter; scores for essays written by hand and by the word processor were about equally above the norm.

Creativity scores for the strong creative ability group improved slightly from essays written by hand to essays written by typewriter (+2.0%), improved modestly from typewritten to word processed essays (+6.8%), and improved by +8.9% when essays written on a word processor are compared with those written by hand. Read in the light of the note above, these apparently small fluctuations are probably quite significant.

2. The average creative ability group had creativity scores that, as might be expected from the initial testing, hovered right around the norm. The highest above norm score for this group was in typing; essays composed by hand and on the word processor had scores for this group that were equally weak in comparison to the norm. The average creative ability group was, consequently, more creative when composing on typewriters than when composing by hand (+9.8%), and slightly less creative on the word processor than on the typewriter (-1.1%); however, essays written on a word processor were still evaluated as more creative than those written by hand (+8.6%).

3. The weak creative ability group, again as would be expected, was consistently under the norm in creativity scores for all three modes of

composing. These subjects were farthest from the norm when composing on typewriters and closest to the norm when composing on a word processor.

The weak creative ability group's creativity scores improved slightly from those achieved by handwriting when composing was performed on typewriters (+2.7%); the apparent contradiction with the previous statement is explained by the fact that the norm increased more than did the scores for this group; this group's scores improved somewhat more for word processed essays as opposed to those written on typewriters (+11.7%), and therefore improved most when word processed essays were compared to handwritten essays (+14.5%).

VI. Hypothesis: The average creative ability group will improve its creativity scores more than the other two groups when composing on a typewriter as compared to writing by hand, but will improve most in relation to the other groups when composing on a word processor as compared to composing by hand. Relative differentiation among the groups will be maintained, however, for all three modes of composing.

Note: Because of the ceiling on achievable scores (see note for Hypothesis V), it is easier for the average creative ability and much easier for the weak creative ability group to appear to improve than the strong creative ability group even though none of their scores may ever be as high as those of the strong group. In other words, small changes in the scores of the strong group are as significant as modest changes for the average group and as large changes for the weak group. The comparisons, therefore, must be seen as relative, not absolute.

Results: 1. The creativity scores improved more for the average creative ability group than the strong or weak creative ability groups when composing was performed on typewriters.

The weak creative ability group improved its creativity scores more than the other two groups when the word processor was employed.

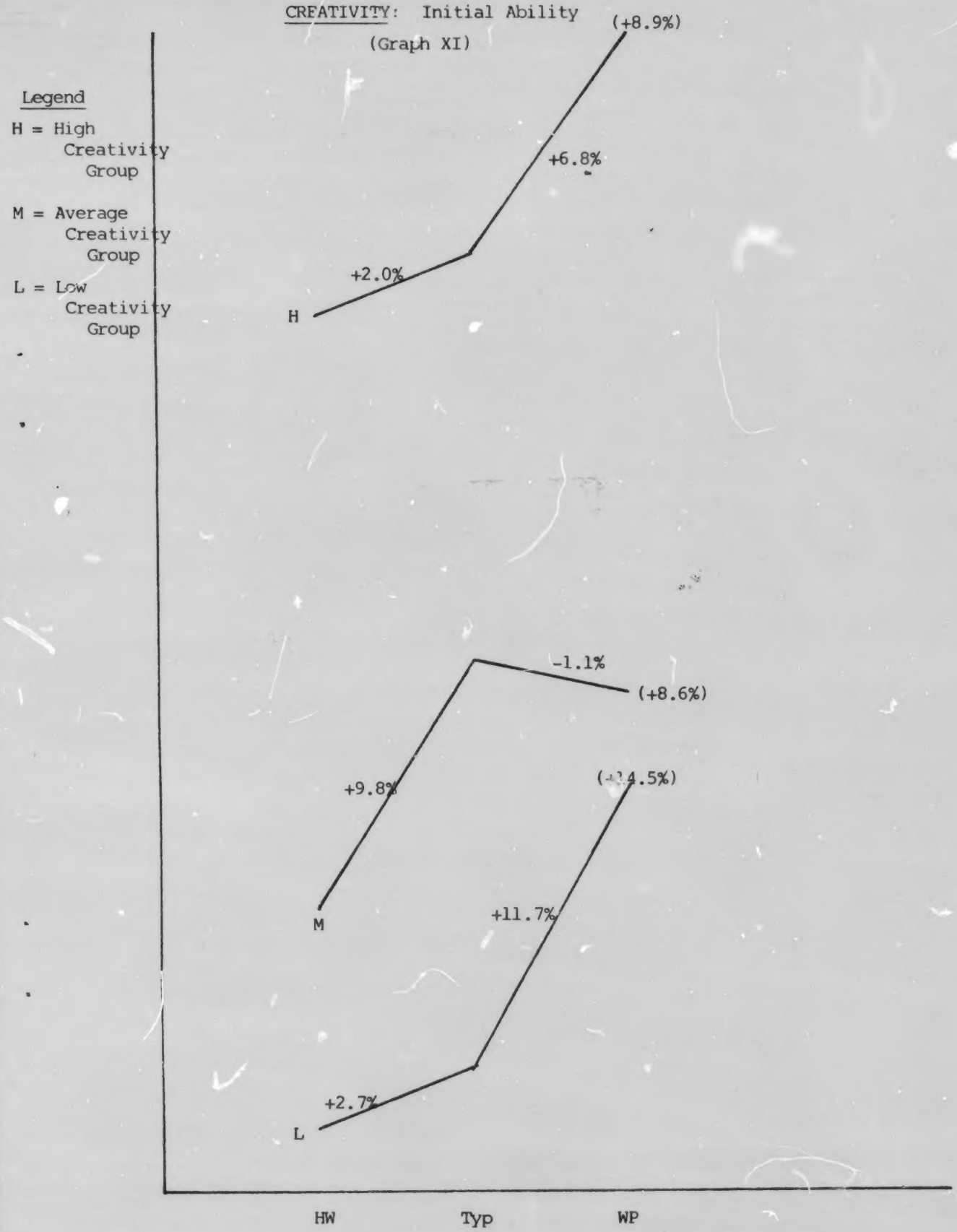
2. There was little, if any, crossover among the three groups, and, therefore, relative differentiation was maintained: the creatively weak group remained weak in relation to the other two, the average creative ability group remained average, and the strong creative ability group strong no matter what the mode of composing. For example, the weak group was never able to catch up with or to exceed the scores of the average or strong group, nor was the average group able to catch up with or to exceed the strong group in any of the three modes of composing; for none of the modes did the scores of the strong group decline below the scores of the average or weak group.

3. However, essays written on a word processor by the weak creative ability group were awarded creativity scores that exceeded those achieved by the average creative ability group when its members composed by hand. In other words, writing with a word processor seems to permit the creativity of weak students to catch up with that of average students writing by hand. However, none of the modes of composing produced creativity scores for the average group as high as the lowest score (handwriting) for the strong group.

4. Graph XI (covering Hypotheses V and VI) presents the creativity curves for the three ability groups. The separation in creative ability predicted for the three groups by the initial testing procedures is clearly confirmed by the differences in scores among the three groups on the essays written by hand. Also obvious is the fact that the average creative ability group (M) was initially closer to the weak creative ability group (L), rather than being half way between the strong (H) and the weak groups. All three groups increased

CREATIVITY: Initial Ability

(Graph XI)



their creativity scores when composing on typewriters, the average group most significantly, the other two groups only slightly. Both the strong and weak creative ability groups improved their creativity scores considerably when writing on a word processor as opposed to writing by hand or on a typewriter. In fact, the improvement for the weak group permits its creativity on the word processor to exceed the creativity of the average group when composing by hand and nearly to match this group's scores on the word processor. Only the average creative ability group showed a decline in scores from typing to word processing, and the decline is slight.

VII. Hypothesis: Scores for writing skills for each creative ability group (strong, average, and weak) will be highest for essays written on the word processor, next highest for essays written on a typewriter, and lowest for those composed by hand (Note: the caveat mentioned after Hypothesis V applies in this instance also).

Results: 1. The strong creative ability group consistently made scores higher than the norm in writing skills for all three modes of composing. This group's lowest above norm scores were for handwritten essays, but these were only slightly lower than the scores for essays produced on the word processor. The highest above norm score was for typing.

For the strong creative ability group, then, typing produced higher scores for writing skills than did essays written by hand (+6.2%). Scores for writing skills for word processing were higher than those for typing in only one instance and marginally lower in the other samples. In other words, there was a slight decline in scores from typing to word processing (-1.0%). However, essays produced on the word processor were clearly superior in writing skills

to those produced by hand (+5.2%). Writing skills for word processing and typing are for the creatively superior student, therefore, about equal.

2. The average creative ability group consistently had scores for writing skills below the norm; its lowest below norm scores were for essays composed by typewriter, its highest below norm scores were for essays composed by word processor. Essays produced by typing by the creatively average group possessed lower scores for writing skills than did essays written by hand (-3.5%); word processing consistently produced better scores for writing skills than typing (+8.5%) and slightly better scores than writing by hand (+4.8%).

3. The weak creative ability group had scores for writing skills similar to the average group: they were consistently below the norm, the lowest below norm scores occurring for essays composed by typewriter and the highest for essays composed by word processor. In effect, the creatively weak group scored considerably lower in writing skills for essays written on a typewriter than for essays written by hand (-11.2%). Essays produced on a word processor by the weak group were significantly better in writing skills than those written on a typewriter (+14.5%), but only slightly better than those written by hand (+3.4%).

VIII. Hypothesis: The average creative ability group will improve its scores for writing skills more than the other two groups when composing on a typewriter as compared to writing by hand, but will improve most in relation to the other groups when composing on a word processor as compared to composing by hand. Relative differentiation among the groups will be maintained, however, for all three modes of composing.

Note: Since the subjects were grouped into strong, average and weak categories according to tests of creativity and inventories of values, one would not expect writing skills necessarily to maintain a similar tripartate division, unless, of course, a strong correlation between creativity and writing skills exists (see Hypothesis IX).

Results: 1. When essays were composed on a typewriter as opposed to being written by hand, the strong creative ability group improved more than the other two groups in scores for writing skills; in fact, the average and weak creative ability groups had scores that declined from handwritten essays to essays composed by typing, the weak group most of all. When the mode of composing is shifted from typing to word processing, the weak group improved most significantly in scores for writing skills; the average group improved moderately, and the strong group declined slightly.

Since the best improvement in scores for writing skills was achieved by the weak creative ability group for essays produced on a word processor as opposed to those written on a typewriter, and since the least improvement in writing skills was also achieved by the weak group, but this time for essays written on the word processor as opposed to those written by hand, we can conclude that typing is the least effective method (typing as opposed to handwriting for this group, in fact, produced the greatest decline for all the groups) of getting good writing skills for the weak creative ability group, and that handwriting and word processing produce about the same level of writing skills.

2. Some crossover for writing skills does exist among the three groups; in other words, relative differentiation was not maintained: the creatively

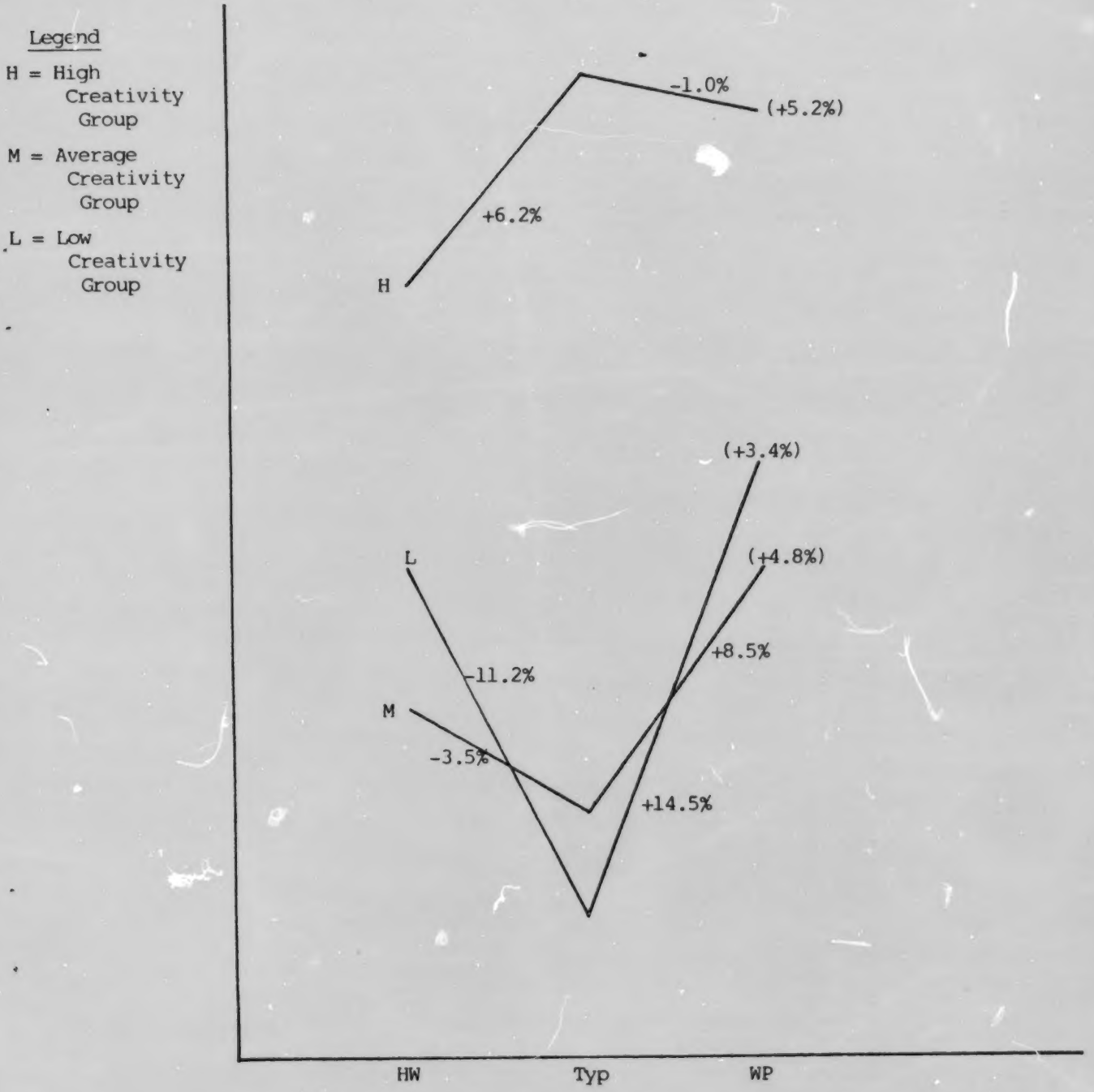
strong group had superior scores for writing skills for all three modes of composing; however, the creatively average and weak groups had nearly identical scores for writing skills for all three modes of composing, these scores being consistently lower than those awarded the strong group. The average creative ability group had slightly lower scores for writing skills than the weak creative ability group for essays composed by hand and slightly higher scores than this group for essays written on a typewriter; the weak group was awarded slightly higher scores in writing skills than the average group for essays produced on the word processor.

3. Once again, neither the weak nor the average creative ability groups ever attained scores for writing skills equal to or greater than those achieved by the strong creative ability group for any of the three modes of composing. Even the most successful essays for the average and weak groups (usually those produced on a word processor) did not achieve scores for writing skills equal to the lowest scores (usually from the handwritten samples) of the strong group. In other words, none of the modes of composing allowed the weak or average group to catch up to the strong group.

4. Graph XII presents the curves for the three ability groups for writing skills scores, and suggests that, although there are some parallels between writing skills and creativity, striking differences exist. First, the average group (M) in creativity was, if we use the handwritten essays as a control, the weak group in writing skills and the weak group (L) in creativity became the average group. However, the strong group in creativity (H) retained its superior position; in other words, there is a good chance that someone who is

WRITING SKILLS: Initial Ability

(Graph XII)



creatively successful will also be successful at writing skills. Second, writing skills declined significantly for the creatively weak and average groups when the mode of composing switched from handwriting to typing; in fact, for typing the weak group's scores for writing skills declined below those of the average group. Only for the strong creative ability group was there an increase in writing skills when composing is performed on a typewriter. Third, both the weak and average creative ability groups increased their scores for writing skills when composing on a word processor, the weak group quite significantly, even exceeding again the average group. The strong group had scores for writing skills when employing a word processor that declined slightly from those achieved by typing. Fourth, for all three groups the scores for writing skills achieved when composing on a word processor were higher than those achieved when composing by hand.

X. Hypothesis: Creativity scores and scores for writing skills will correlate closely for men and women and for all three ability groups.

Note: To clarify the implicit connection between creativity and writing skills suggested by the discussion of Hypothesis VIII, a number of statistical tests were performed to attempt to determine the degree of correlation, both in general and for particular subgroups, between creativity scores and scores for writing skills. The question here is, of course, whether an assessment of creativity can serve as a predictor for the level of writing skills, and whether writing skill level can, if we have a reversible equation, predict the degree of creativity.

Percentages define the difference between the two scores (for creativity and writing skills) in relation to the combined score. Clearly, the smaller

the percentage, the smaller the difference and therefore the greater the correlation. Five to six percent or less provides a correlation that is reliable, whereas anything larger is unreliable.

Results: 1. The overall correlation between creativity and writing skills is quite high: 0.61%. Another way of indicating this close correlation is to compare total scores: the six evaluators awarded 813 points for creativity to the thirty-six essays (an average of 3.76 points per essay), and 818 points for writing skills (an average of 3.78 points per essay).

2. The correlations for each of the composing modes were also quite reliable:

Handwriting: 4.80%

Typing: 2.22%

Word Processing: 0.72%

3. Only the low creative ability group yields an instance of unreliable correlation:

Strong Creative Ability: 3.82%

Average Creative Ability: 1.92%

Weak Creative Ability: 8.46%

4. A mid-range factor analysis produces the following results for correlation reliability:

a. Correlation for women for the three modes of composing:

Handwritten essays: 9.52% (unreliable)

Typed essays: 6.94% (marginally reliable)

Word processed essays: 3.95% (reliable)

b. Correlation for men for the three modes of composing:

Handwritten essays: 0.80% (reliable)

Typed essays: 11.76% (unreliable)

Word processed essays: 5.76% (reliable)

c. Correlation for the strong creative ability group and the three modes of composing:

Handwritten essays: 3.96% (reliable)

Typed essays: 0.00% (reliable)

Word processed essays: 8.00% (unreliable)

d. Correlation for the average creative ability group and the three modes of composing:

Handwritten essays: 3.53% (reliable)

Typed essays: 8.89% (unreliable)

Word processed essays: 0.00% (reliable)

e. Correlation for the weak creative ability group and the three modes of composing:

Handwritten essays: 15.73% (unreliable)

Typed essays: 2.53% (reliable)

Word processed essays: 6.52% (unreliable)

X.A. Hypothesis: Persuasive essays written on a word processor will be creatively superior to persuasive essays written on a typewriter, and those composed on a typewriter will be creatively superior to those written by hand.

Results: The least creative persuasive essays were written by hand, while the most creative persuasive essays were written by word processor. Typing, therefore, produced persuasive essays that, for the most part, were ranked between the other two groups. Typing increased creativity scores for persuasive essays above those achieved by persuasive essays composed by hand (+4.6%); the increase in creativity for persuasive essays from typing to word processing was similarly marginal (+3.6%). Creativity scores for persuasive essays composed on a word processor were, therefore, superior to those achieved by the persuasive essays written by hand (+8.3%).

X.B. Hypothesis: Expository essays written on a word processor will be creatively superior to expository essays written on a typewriter, and those composed by typewriter will be creatively superior to those written by hand.

Results: Once again, this specific subgroup reflects the larger trend. The least creative expository essays were written by hand, while the most creative expository essays were written by word processor. Typing produced expository essays that were, for the most part, ranked between the other two groups. Typing increased creativity scores for expository essays above those achieved by expository essays composed by hand (+4.8%); the increase in creativity for expository essays from typing to word processing was slightly greater (+7.6%). Creativity scores for expository essays composed on a word processor were superior to those achieved by the expository essays written by hand (+12.5%).

X.C. Hypothesis: There will be no significant difference in creativity scores between persuasive and expository essays written by hand, between persuasive and expository essays written on a typewriter, or between persuasive and expository essays written on a word processor.

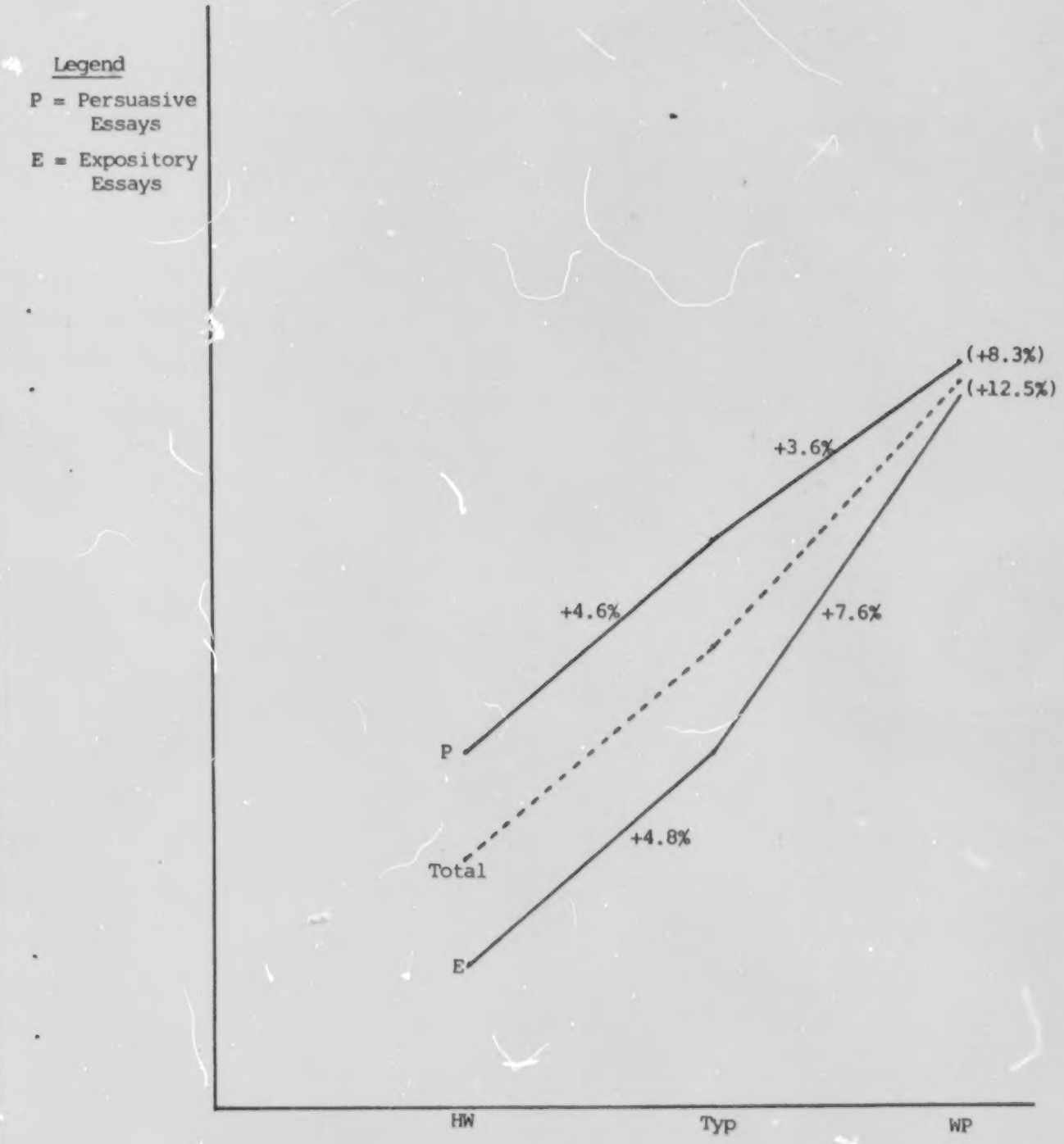
Results: 1. Expository essays increased in creativity scores more dramatically than did the persuasive essays when the mode of composing changed from writing by hand to typing and from typing to word processing.

2. However, persuasive essays were judged to be creatively superior to expository essays when the writing took place either by hand or on a typewriter; in other words, relative differentiation was maintained for two of the three modes of composing. The creativity scores of the two types of essays were, however, virtually identical when the mode of composing was by word processor.

3. For the most part, Graph XIII (which covers Hypotheses X.A., B., and C.) shows the expected linear increase in creativity of the overall curve (Hypotheses I) for both persuasive and expository essays from writing by hand to typing to word processing. In both cases, the persuasive essays were rated for all three modes of composing to be creatively superior to the expository essays. However, Graph XIV, which collapses the origins to a common point, shows the greater increase in creativity of the expository essays than the persuasive essays from typing to word processing.

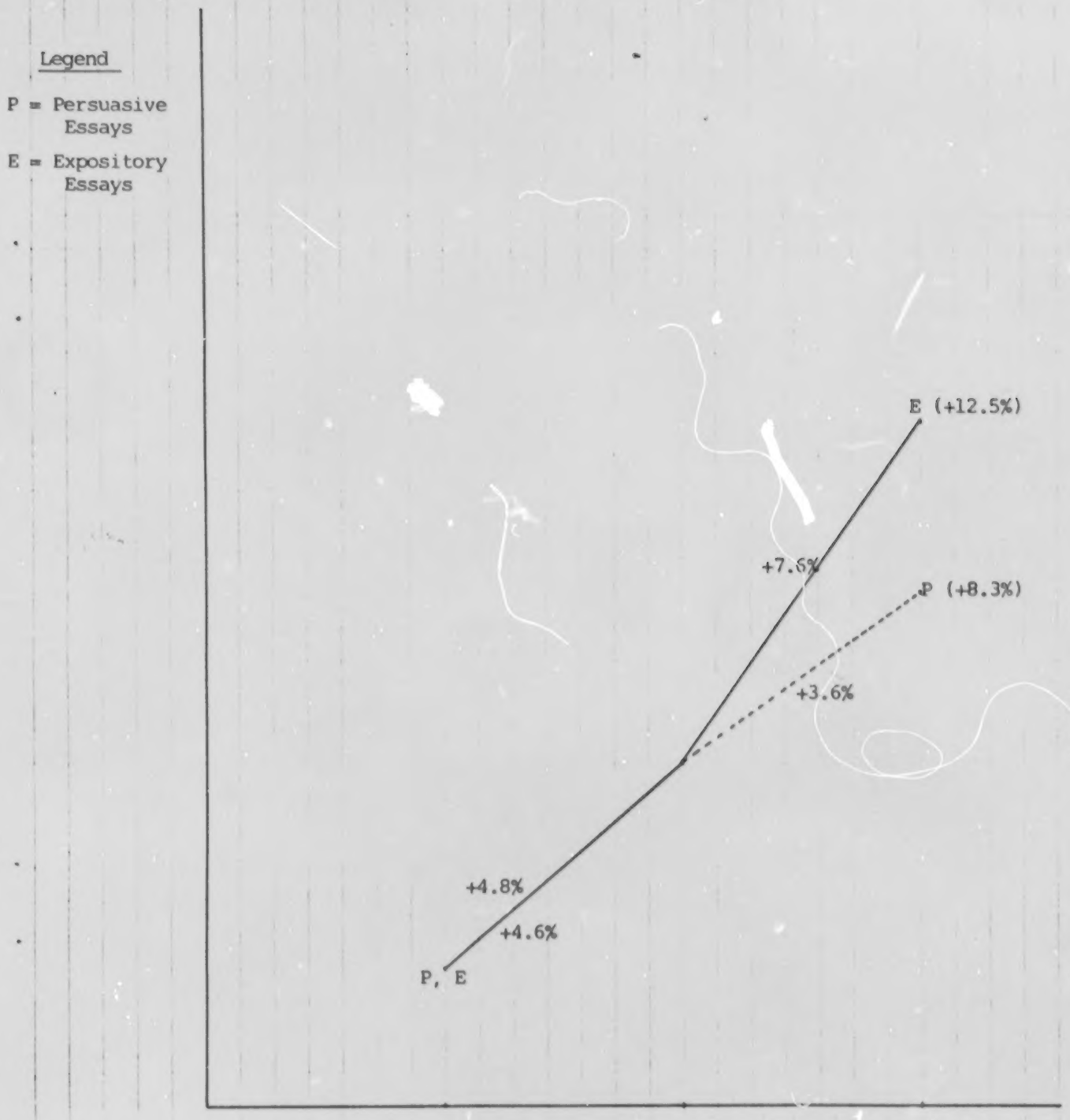
CREATIVITY: Rhetorical Mode

(Graph XIII)



CREATIVITY: Rhetorical Mode (Collapsed Origins)

(Graph XIV)



XI.A Hypothesis: Persuasive essays written on a word processor will demonstrate better writing skills than persuasive essays written on a typewriter, and those composed on a typewriter will be superior in writing skills to those composed by hand.

Results: Persuasive essays composed on a word processor were uniformly judged to have superior writing skills as compared to essays composed by hand or on a typewriter. The persuasive essays written by typewriter declined in scores for writing skills from those of the handwritten essays (-2.9%); the increase in writing skills for persuasive essays from typing to word processing was considerable (+9.1%). Scores for writing skills for persuasive essays composed on a word processor were, therefore, superior to those for persuasive essays composed by hand (+6.1%).

XI.B Hypothesis: Expository essays composed on a word processor will demonstrate better writing skills than expository essays composed on a typewriter, and those composed on a typewriter will be superior in writing skills to those composed by hand.

Results: The expository essays composed on the typewriter were judged to have worse writing skills than those composed by hand, although the differences were not great. Expository essays composed on a word processor were somewhat better in writing skills than those composed on a typewriter (+5.3%) and slightly better than those written by hand (+3.0%). Scores for writing skills declined for expository essays from composing by hand to writing on the typewriter (-2.2%).

XI.C Hypothesis: There will be no significant differences in scores for writing skills between persuasive and expository essays written by hand, between persuasive and expository essays written on a typewriter, or between persuasive and expository essays written on a word processor.

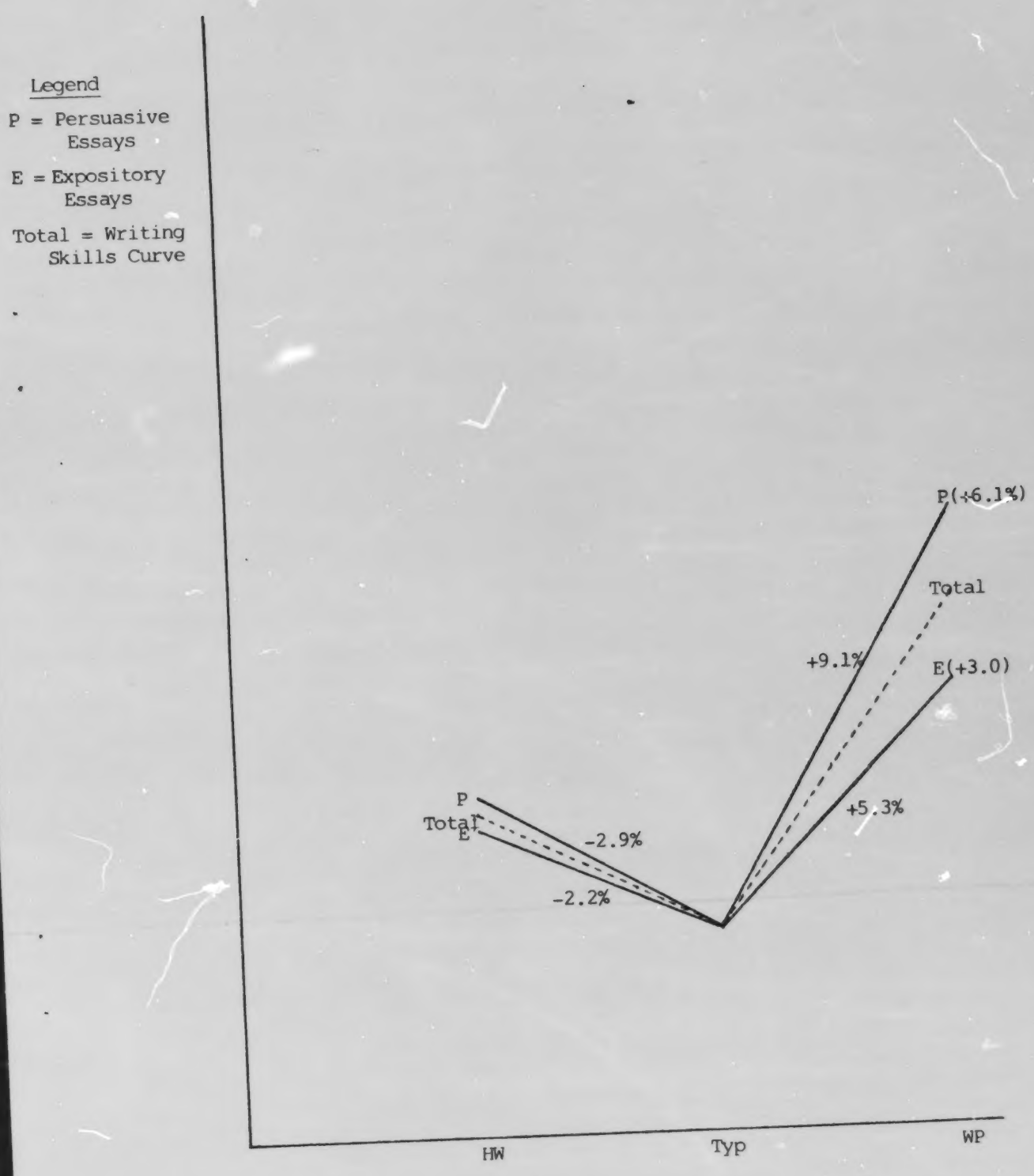
Results: 1. Although both the persuasive and expository essays increased their scores for writing skills when they were composed on a word processor as compared to when they were composed on a typewriter or by hand, the gains were frequently greater for the persuasive essays.

2. The persuasive essays generally possessed better writing skills than the expository essays, although this superiority of the persuasive essays is at best marginal except for those composed on a word processor: persuasive essays were judged to be slightly superior to expository essays in writing skills when the mode of composing was by hand, but there was virtually no difference between the two types of essays when composing was performed on the typewriter.

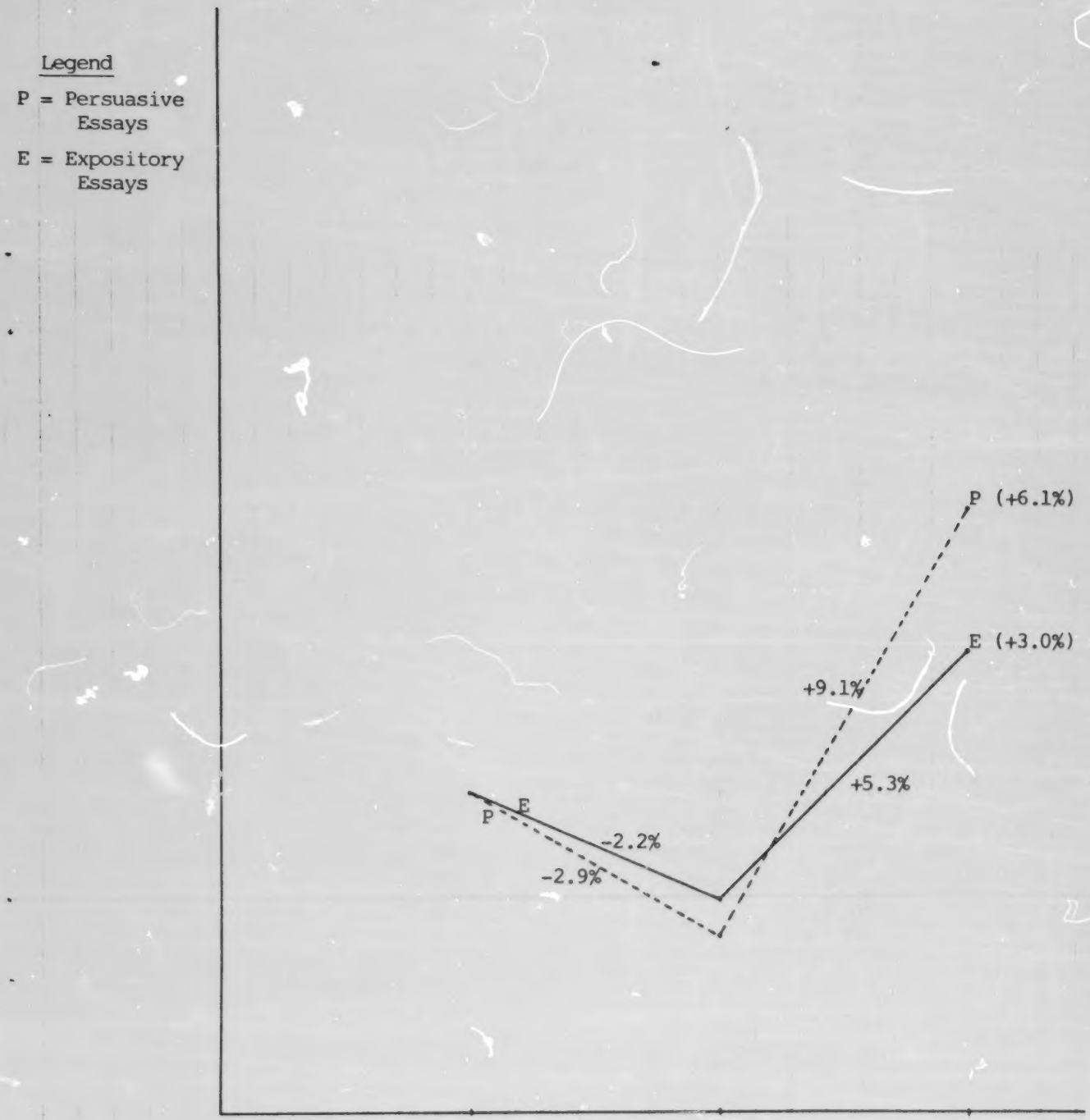
3. For the most part, both Graph XV (which covers Hypotheses XI.A., B., and C.) shows that typing produced a decline in scores for writing skills from those for writing by hand for both persuasive and expository essays; word processing produced scores for writing skills that were significantly superior to those for either of the other two modes of compos g. Thus these curves reflect the overall curve (Hypothesis II) even though persuasive essays seem generally to have been viewed as possessing superior writing skills to expository essays. Graph XVI, which collapses the origins to a common point, shows the persuasive essays declining slightly more dramatically in scores for writing skills from handwriting to typing than expository essays, and increasing slightly more dramatically in scores for writing skills from typing to word processing.

WRITING SKILLS: Rhetorical Mode

(Graph XV)



WRITING SKILLS: Rhetorical Mode (Collapsed Origins)
(Graph XVI)



XII. Hypothesis: There will be no significant difference between the creativity scores provided by the evaluators from the humanities and those provided by the science evaluators.

Results: The humanities evaluators consistently awarded higher creativity scores (19.4% greater) than did the evaluators from the sciences. The two groups disagreed on creativity scores for thirteen of thirty-six evaluations (36%) and agreed for twenty-three of thirty-six evaluations (64%). The humanities evaluators awarded creativity scores to essays written by hand that were 17.5% higher than those awarded by the science evaluators, 30.0% higher for essays written on a typewriter, and 11.8% higher for essays written by word processor. In other words, there was greatest disagreement between the two groups of evaluators about creativity for essays written on a typewriter (six out of twelve evaluations disagreed), and greatest agreement for essays written on the word processor (ten out of twelve evaluations agreed).

XIII. Hypothesis: There will be no significant difference between the scores for writing skills provided by the evaluators from the humanities and those provided by the science evaluators.

Results: The humanities evaluators were only +1.5% more generous than the science evaluators when assessing writing skills, a value that is considerably less than significant; the two groups disagreed on scores for writing skills for six out of thirty-six times (16.7%; about half as much disagreement as with creativity) and therefore agreed thirty out of thirty-six times (83.3%). The humanities evaluators awarded slightly lower scores for writing skills than the science evaluators for the essays written by hand (-2.8%) and for the essays composed on the word processor (-1.1%) -- neither of these is significant --,

but somewhat higher scores for essays composed on a typewriter (+8.3%). The greatest disagreement occurred over essays composed on a typewriter (four out of twelve evaluations), and the greatest agreement occurred for essays composed by hand and for essays composed on a word processor (eleven out of twelve evaluations in both cases).

Comparisons between Hypothesis XII and Hypothesis XIII: 1. For all seventy-two scores (creativity and writing skills), there were nineteen moderate disagreements (26.4%). The disagreements concerned creativity in 18.1% of the cases while less than half of that or in 8.3% of the cases the disagreements were over writing skills.

2. In general, there was not much difference for the humanities evaluators between the scores awarded for creativity and for writing skills (4.1%). The science evaluators were considerably harsher in their awards for creativity than for writing skills (13.1%).

XIV. Hypothesis: The accuracy of initial placement of subjects in one or the other of the three ability groups as a result of preliminary testing will be confirmed by the subsequent evaluation of their writing.

Note: this test serves, as well, as a good check on interrater reliability. If, indeed, the evaluators are close to each other in their assessment of the creativity of the essays, then those subjects tested initially as having strong creativity should be rated as having scores in the upper half and possibly the upper third of the scoring spectrum. Conversely, those subjects tested initially as having weak creativity should be rated as having scores in the lower half and possibly the lower third of the scoring spectrum.

Results: All twelve of the scores for the strong creative ability group are contained in the upper half, and eleven of the twelve scores for the weak group are contained in the lower half. The average creative ability group, as one would expect, is about equally divided between the upper and lower halves, with a slight bias toward the lower half:

	High			Average			Low		
	C	F	Tot.	A	D	Tot.	B	E	Tot.
Upper:	6	6	[12]	2	3	[5]	0	1	[1]
Lower:	0	0	[0]	4	3	[7]	6	5	[11]

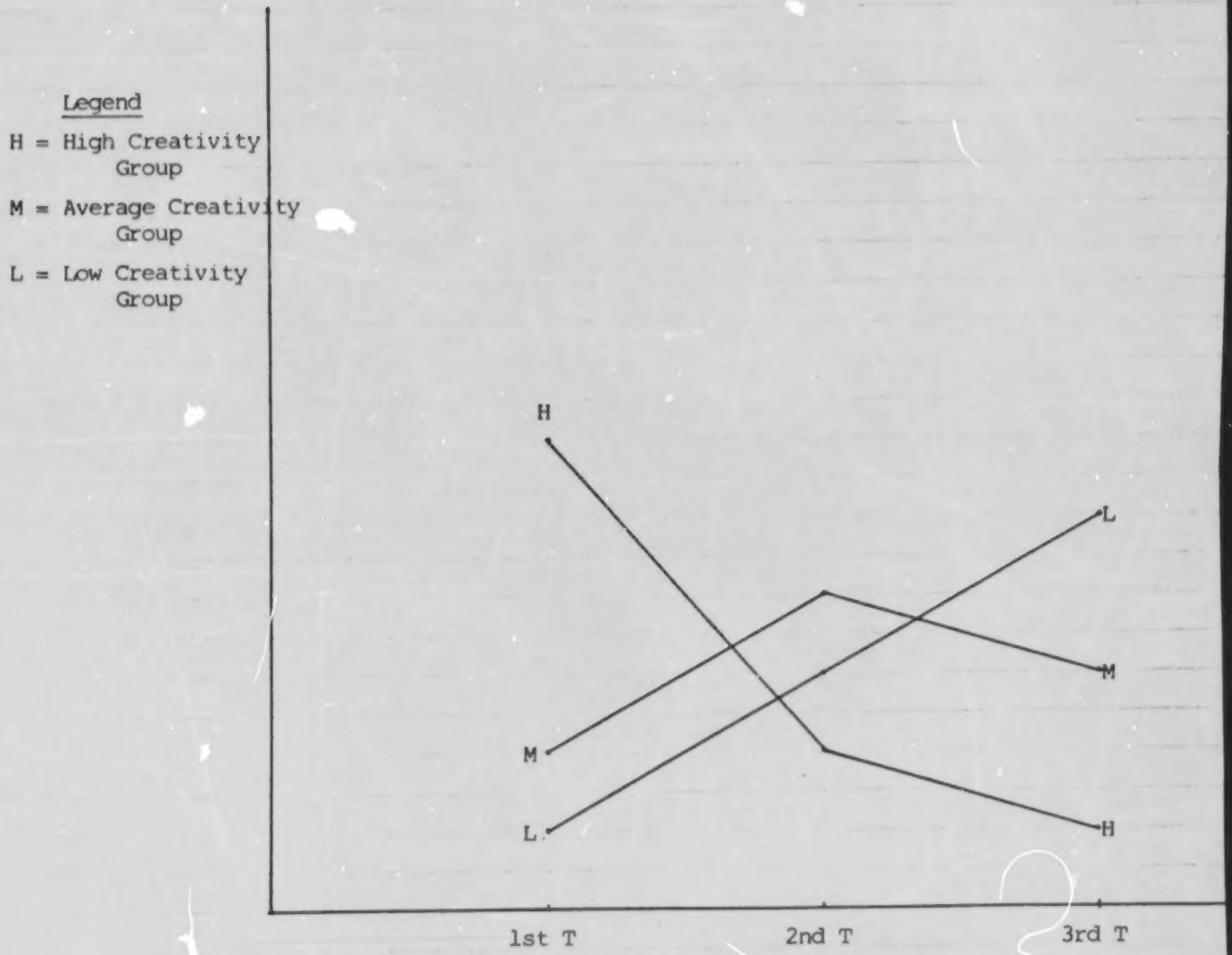
Dividing the scoring spectrum into thirds provides an even more exacting test of interrater reliability: ideally, the strong creative ability group would have all of its twelve scores in the upper third and no scores in the middle or lower thirds; the average creative ability group would have all twelve of its scores in the middle third; the weak creative ability group would have all of its scores in the lowest third. This is close to what occurred: the strong creative ability group has scores primarily in the upper third, the average group primarily in the middle third and the weak group primarily in the lower third (see Graph XVII).

	High			Average			Low		
	C	F	Tot.	A	D	Tot.	B	E	Tot.
Upper:	4	6	[10]	2	0	[2]	0	0	[0]
Mid:	2	0	[2]	2	4	[6]	1	3	[4]
Low:	0	0	[0]	2	2	[4]	5	3	[8]

Although the subjects were grouped primarily according to creativity potential and not according to ability at writing skills, a symmetric

CREATIVITY: Ability Groups (Distribution of Scores by Tercile)

(Graph XVII)



distribution similar to that for creativity exists for writing skills. Thus, as we have seen earlier, students strong in creativity tend also to be strong in writing skills, students weak in creativity tend also to be weak in writing skills, and students with average creative potential tend correspondingly to possess rather average writing skills. The correlation, however, is not exact: students with strong creative potential are not as good at writing skills as they are at creativity -- they have a moderate amount of difficulty with these matters; students with weak creative potential, on the other hand, may be somewhat better at writing skills than they are at creativity -- in effect, they have more difficulty being creative than they do with achieving modest success with the skills of composing:

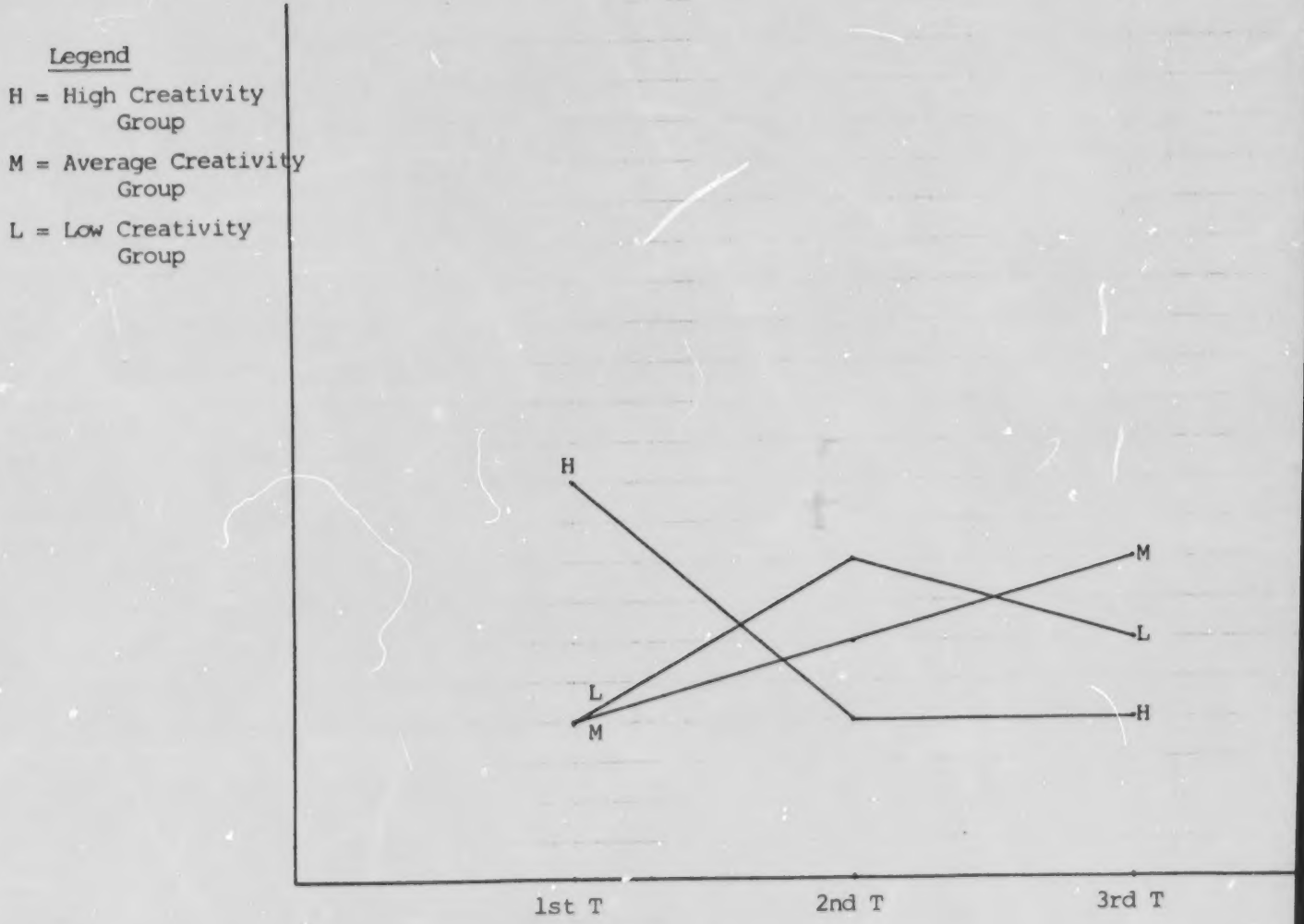
	High			Average			Low		
	C	F	Tot.	A	D	Tot.	B	E	Tot.
Upper Half:	3	6	[9]	4	1	[5]	2	2	[4]
Lower Half:	3	0	[3]	2	5	[7]	4	4	[8]

Division of the scoring spectrum into thirds shows the strong creative group still to be fairly proficient at writing skills; both the average and the weak creative ability groups, however, display diminished ability with writing skills. Creativity seems to correlate with writing skills less well for the average group (see Graph XVIII):

	High			Average			Low		
	C	F	Tot.	A	D	Tot.	B	E	Tot.
Upper third:	2	6	[8]	2	0	[2]	1	1	[2]
Middle third:	2	0	[2]	2	2	[4]	4	2	[6]
Lower third:	2	0	[2]	2	4	[6]	1	3	[4]

WRITING SKILLS: Ability Groups (Distribution of Scores by Tercile)

(Graph XVIII)



STUDENT EVALUATIONS:

In this section I would like to summarize briefly the responses of the students involved in the project and include a sampling of their comments by way of providing descriptive answers to some of the questions central to this experiment. These comments will be organized according to type of response, and identified by sex and ability group.

All six subjects were asked to submit within two weeks after the last writing session a description of how they felt their writing process had changed as their mode of composing had changed. Generally speaking, these responses confirm the statistical results presented earlier: 1. five of the six students wrote enthusiastically and articulately about the use of the word processor as a means of composing. Only one subject (the female member of the creatively superior group) was negative; she definitely preferred to compose by hand, although writing on the word processor came in a strong second; 2. the statistical results suggest that typing produces the worst writing skills, but the second best creativity scores; however, the student evaluations were universal in condemning this mode of composing: not one felt happy about his or her writing when using a typewriter; 3. all five of the students who preferred the novelty of composing on a word processor ranked the traditional composing mode of writing by hand as second, many of them suggesting that the best of all worlds would be a blend of word processing and handwriting, particularly for revising.

Several students strongly recommended using word processors in the writing classroom both to improve composing skills and to win back the hearts and minds of writers whose interest had been dampened and discouraged by traditional

methods of composition pedagogy. After the experiment had concluded, several inquired (and in fact the inquiries continue to date) about using the word processors for future written assignments, and one or two contemplated purchasing computers with word processing capability for personal and career use. It is worth noting in this regard that these responses were not prompted, for I had in fact been quite careful throughout and after the project to conceal any bias I might have had.

What did the five students who responded positively about word processing see as its advantages? Their evaluations provided several answers to this question:

1. Composing with a word processor was more efficient than writing by hand or on a typewriter:

(H, M): "[The word processor] increased the amount of writing I could produce in a given period of time."

"The quantity of finished material I can produce on the word processor is greater than what I would accomplish by either longhand or typewriting, especially the latter."

(Mid, M): "The word processor saved time in writing, correcting, the setting up of the format of the essay and the eventual printing of the finished copy."

2. Word processing made writing easier and more fun:

(H, M): "The word processor is in my opinion the superior system for composing. I can simply let the words flow out on the screen without any worries."

"On one occasion, I wrote the first two chapters of a story for Creative Writing. This I did in one nine hour sitting with only two breaks of less than ten minutes each. The first draft required virtually no revision and was in my mind the best work that I have ever produced."

(Md, F): "It was a treat to compose on this machine, as everything you typed into the machine was displayed in front of you on a screen."

(L, M): "I have never been able to write essays before, and I never enjoyed it, but I felt that I learned a lot in the few weeks that I worked on this project."

"This is really a great machine, this Micom, it is quite unlike any machine that I have ever used."

(L, F): ". . .I found the word processor superior to any other forms of writing. I found it so much easier to think up ideas and incidents. Likewise the content, style and organizational structure was much easier done on the word processor."

3. Word processing improved the quality of written work:

(H, M): "It [the word processor] also improved the mechanics of my writing and improved the creativity in it."

"I would if I had the option continue to do all of my writing on the word processor. It has improved the general quality of my work."

(Md, F): "My essays, when composed on the word processor were what I classify as a work of art. They were mistake free, they flowed and I felt exceedingly confident about the finished product."

4. Word processing enhanced creativity and the writing process in general:

(H, M): "Comparing the two modes, typewriting and word processing, I believe that the latter is the superior in creativity. The fewer distractions one has in operating the machine, the more energy one can channel into that piece of work."

(H, F): "[I would probably choose] hand writing as a first draft and then the word processor for second drafts -- get all the creativity etc. out when writing by hand and continue with the technicalities on the word processor."

(Md, M): ". . . the putting of the screen material into a recallable memory helps in the incubating process of writing. Once in the memory, the material can be instantly recalled, then if changes are to be made, they can be easily introduced onto the screen and then updated in the memory."

(L, F): "For some odd reason I found myself more imaginative and interested in what I was typing about."

5. The most extensive comments concerned the ease and efficiency of revising, editing, proofreading, formatting and printing on a word processor:

(H, M): "Being able to make corrections or additions is quite easy and there is no need to even consider any of the other functions on the machine. Just go on typing until the idea is complete; then in one easy action the pages, margins and any errors can be corrected. Once my first draft is done, I find that the typewritten or word processed copies are the easiest to edit. Due to my poor penmanship, I find that my own work is difficult to go through. I find that I can do much of my editing on the word processor."

(H, F): "If you can get an essay out on the typewriter or the word processor, [recopying] is a lot faster and easier than handwriting . . ."

"With the word processor I found that I did not have to worry about the paper or the typographical errors, also the silenter operation was also beneficial. With the word processor I found that I did not have to worry about the format; I simply kept on working."

(Md, M): "Being able to move words or paragraphs around before printing and the ability to delete errors, I found to be of the greatest aid. Because of this ability, I feel that organization of an essay was much easier and vastly more efficient."

(Md, F): "If you had to correct grammar or spelling, you simply pushed a button and it was done. There were no cluttering rewritten words above the mispelt ones. Even upon deciding that a sentence could be more effective if it were constructed differently, you either deleted the entire sentence and re-entered it, or seemingly picked up a word and inserted it in the desired spot.

Once a page of the essay was completed, you memorized it into the machine and went on to the next page. Every page would be memorized onto a disk and could be displayed on the screen by simply pushing a button. After reading and re-reading the essay and making every conceivable change or correction, you pushed a button and the essay was immediately typed for you."

(L, F): "It made editing and proofreading a breeze, and I found that my thoughts were more flowing and organized than with anything else. But one of the most significant things about these computers is the ease with which one can erase and fix any mistakes directly on the screen. It only takes the push of a few buttons and everything is in order again. For a person who makes a lot of typing errors and consequently wastes a lot of paper, I couldn't be happier with the word processor."

Let me conclude this section in three ways: first, by permitting the one dissenting voice to have its say; second, by citing what some of the students felt were the disadvantages of composing by hand and by typewriter; and third, by summing up with a few general testimonials from the evaluations.

The student who did not like composing on a word processor found writing with a typewriter even worse, preferring handwriting over both of the mechanical modes. Everything about the writing process, creativity, organization, style, enjoyment -- everything except proofreading -- was for her facilitated best by handwriting:

(H, F): "I felt that it was easier to think of something to write when the ideas went from hand to paper. The mechanization of this process seemed to hinder my creativity."

"Again, scribbling out is easier than 'put and get' -- it's faster and you don't lose track of your thoughts. Correcting spelling mistakes, etc. is the same by hand as by word processing."

"I can't read my [hand]writing after all the scribbling out -- it is not organized the way it is on the word processor. [But] when you have paper you can flip back and forward without losing your place, but with the screen you lose your concentration when recalling previous pages and next pages. Also, the paper was tangible and I don't know if that should have anything to do with it but it did for me. On paper I knew I had written something but until it was printed on paper from the word processor I felt like I was just starting."

Although this subject clearly preferred the traditional method of composing, two students spoke at length about the problems of writing by hand:

(Md, F): "Even though I am used to handwriting, there are a few factors that seem to hamper the quality of my final draft of an essay. One factor is the mess and confusion involved in corrections and the reorganization of words and thoughts. Another is the tiring of my hand which is better known as writer's cramp and still another is the amount of time spent writing and rewriting.

When correcting and reorganizing thoughts on a handwritten project, you end up with lines crossing out incorrect spelling and arrows accompanied by explanations of where a particular phrase would be better suited. You very soon have an extremely messy and confusing sheet of paper in front of you. It is then necessary to rewrite the entire essay. By this time, chances are my hand is becoming quite stiff and you really do not feel like rewriting your five hundred word essay. Nevertheless, you begin wearily to rewrite the five pages, taking time to note all of the corrections and reorganized thoughts, carefully transferring them double-spaced onto a clean sheet of paper.

Finally, it's completed, you re-read it and realize that paragraph twelve would be much more effective if it were exchanged with paragraph eleven. In a final draft, you have no other alternative than to rewrite again. This is monotonous."

(Md, M): "I have never liked to write essays and the freehand method has until this time been the only method I have used. It is a time consuming method in both the rough first writing and the subsequent drafts to get the finished product. The actual writing is a tiring, strainful situation and does not lead to a creative writing environment."

The one student who disliked composing on the word processor was especially discouraged by working with the typewriter:

(H, F): "I thought I would never write again after using the typewriter. I really hated that part. I enjoyed writing by hand and with the word processor it was so-so -- I was wishing that I could write the essay by hand. The probable reason for this is that I have spent 16 years or so putting pen to paper and only two months typing on a screen . . . ."

"I like the word pro better than the typewriter because you could change your mind halfway through. When writing on the typewriter I felt that I had to stick with my choice all the way through."

Others found the typewriter slow, tiring, cumbersome and distracting:

(Md, M): "A method that is somewhat more complicated is the using of the typewriter. This machine takes a great deal of practice before anyone can gain any speed or proficiency at using it for writing. Correcting mistakes seems to be a lot harder. And unless the user has a great deal of experience, they spend much more time trying to figure out how the machine works than on writing."

(Md, F): "The second method used in Mr. Collier's experiment was the typewriter. This was the worst, as I have never had so much trouble trying to express myself through the use of something as mechanical and as awkward as a typewriter. Not only was it necessary to correct spelling mistakes, but now there was the need to correct typing mistakes. In between the double-spaced typed lines, I ended up with an array of corrections. To move a sentence was even worse, as the only writing implement used was the typewriter. Either the move was explained in typing beside the section to be relocated, or, it was

remembered. I spent the majority of my time making mental notes of all of the corrections and this interferred with my organized, creative thought patterns.

Being creative in an organized fashion is not an easy thing to do with so many distractions. Another distraction was the ringing of the typewriter bell whenever it was time to return the carriage, the clicking of the keys and the cold, mechanical feel of the typewriter itself. What a joke, trying to be creative on a metal machine that clunked, clicked, rang bells and entailed pressing the correct key to get a correct response.

Accompanying all of these drawbacks is still another: the amount of time used for the polishing of the final draft. Just as in a handwritten essay, once you have gotten rid of all those distracting corrections, inserts and directions for moving parts of the essay by rewriting, can you reread it. If you notice something else that would enhance your word of art, the chances are you must begin the time consuming procedure of re-doing the entire essay. I rarely finished my typewritten essays."

What sort of overall assessment did the student evaluations provide? And what kinds of suggestions for the future of writing instruction and word processing did they make? What follows is a sampling of these more speculative responses:

(H, M): "Of the three means of composing . . . I have found that I prefer to compose on the word processor. Failing this, I would then choose to compose by long hand. I do not like using the typewriter."

(H, M): "With professional writing to be a major part of my future career, I have now determined that a word processor will be high on the list of purchases when I enter this career."

(H, M): "[What I would like to see is] an automatic memory to prevent the accidental loss of manuscript and secondly, a function that would automatically check for spelling errors and point them out."

(Md, M): "Of the three methods used, I found the word processor to be the best method."

(Md, M): "The one regret that I have is that this aid is not used in helping senior high school or university students in their writing. By using this machine, they could get double benefits: they learn how to use a tool which is being used in business and their writing is sure to need less time."

(Md, F): "Given the choice of methods in which to transfer thoughts into words on paper, my first choice will always be a word processor."

(L, F): "Only now can I understand why [a former teacher was so infatuated with his Apple computer], since I am going through the same thing which my typing teacher went through -- I'm hooked too! And let me tell you [in what way] you got me hooked on those damn computers: I'm so hooked that I'm taking Data Processing next fall."

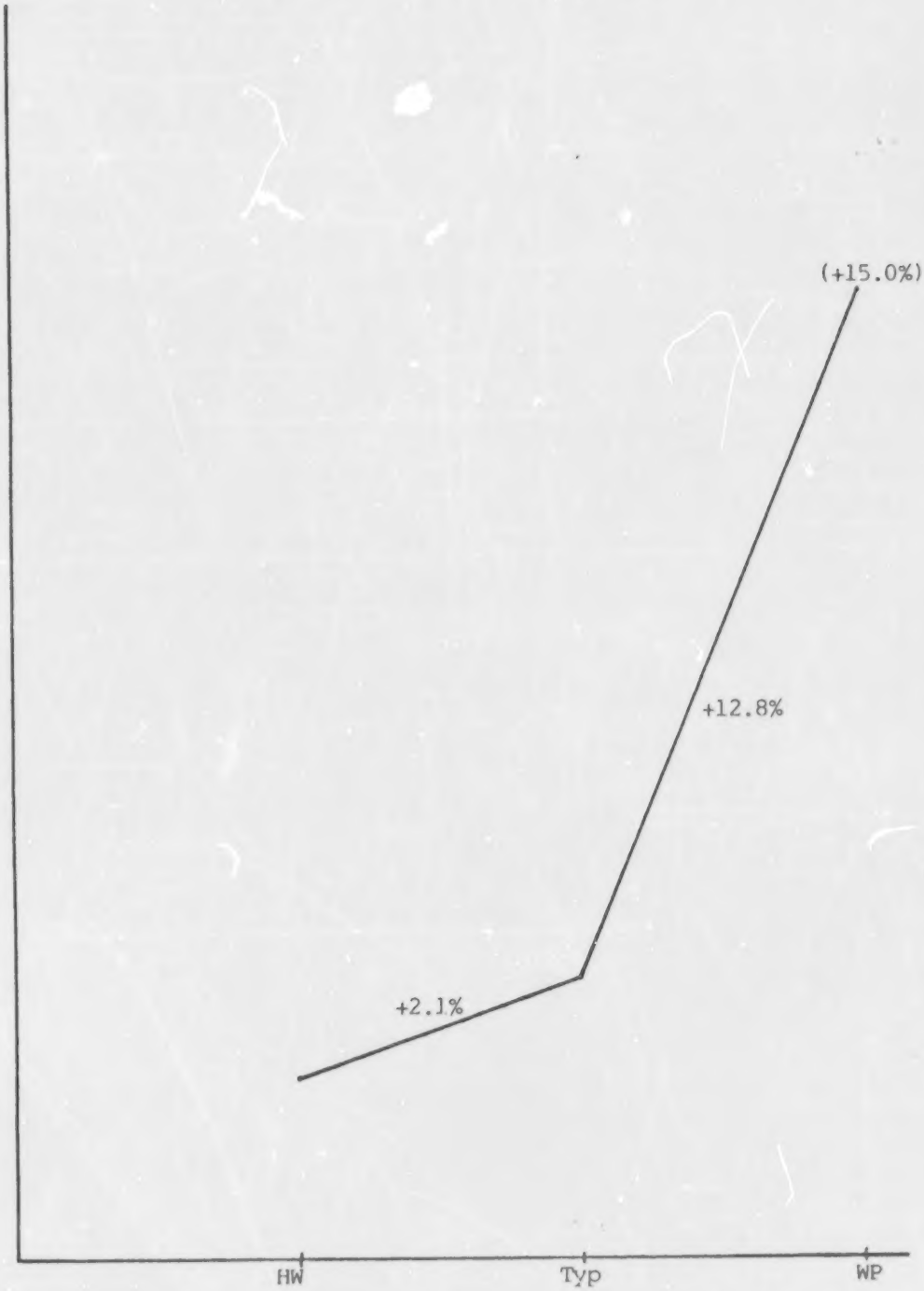
(L, F): "Do I think the word processor will help future English students? You bet I do. Having composed essays by handwriting, typewriting and finally by word processing, the latter is my choice."

SUMMARY AND DISCUSSION:

A quick glance at the combined scores, presented on the right-hand side of the table in Appendix C, will show that the decrease in writing skills when composing shifts from handwriting to typing, almost nullifies the increase in creativity. If we assume that at least a modest portion of success in composing, derives from a reader's perception that a particular text is successful in terms of both its creativity and its overall writing skills, then it would appear that there is not much difference in this regard between texts written by hand and those composed on a typewriter (+2.1%). However, a very noticeable and significant improvement in combined scores and thus in text quality seems to occur when writing takes place on a word processor. Such writing was assessed by the six evaluators in the study to be +12.8% superior to texts composed on a typewriter and +15.0% superior to texts written by hand (see Graph XIX). I think it is safe to say, then, that the experiment strongly suggests that for a wide variety of writing students the word processor is the most advantageous composing instrument. Let me emphasize that this conclusion does not take directly into account the obvious positive shift in attitude and motivation toward writing that the students' comments evinced, nor does it suggest the degree of improvement we might find if composing on the word processor were united in the writing lab with excellent teaching of heuristics, rhetoric, revising strategies, and the like, designed especially for a computer-based environment. In other words, the 15% improvement in the quality of essays from those written by hand to those written on a word processor is a

COMBINED SCORES: Creativity and Writing Skills

(Graph XIX)

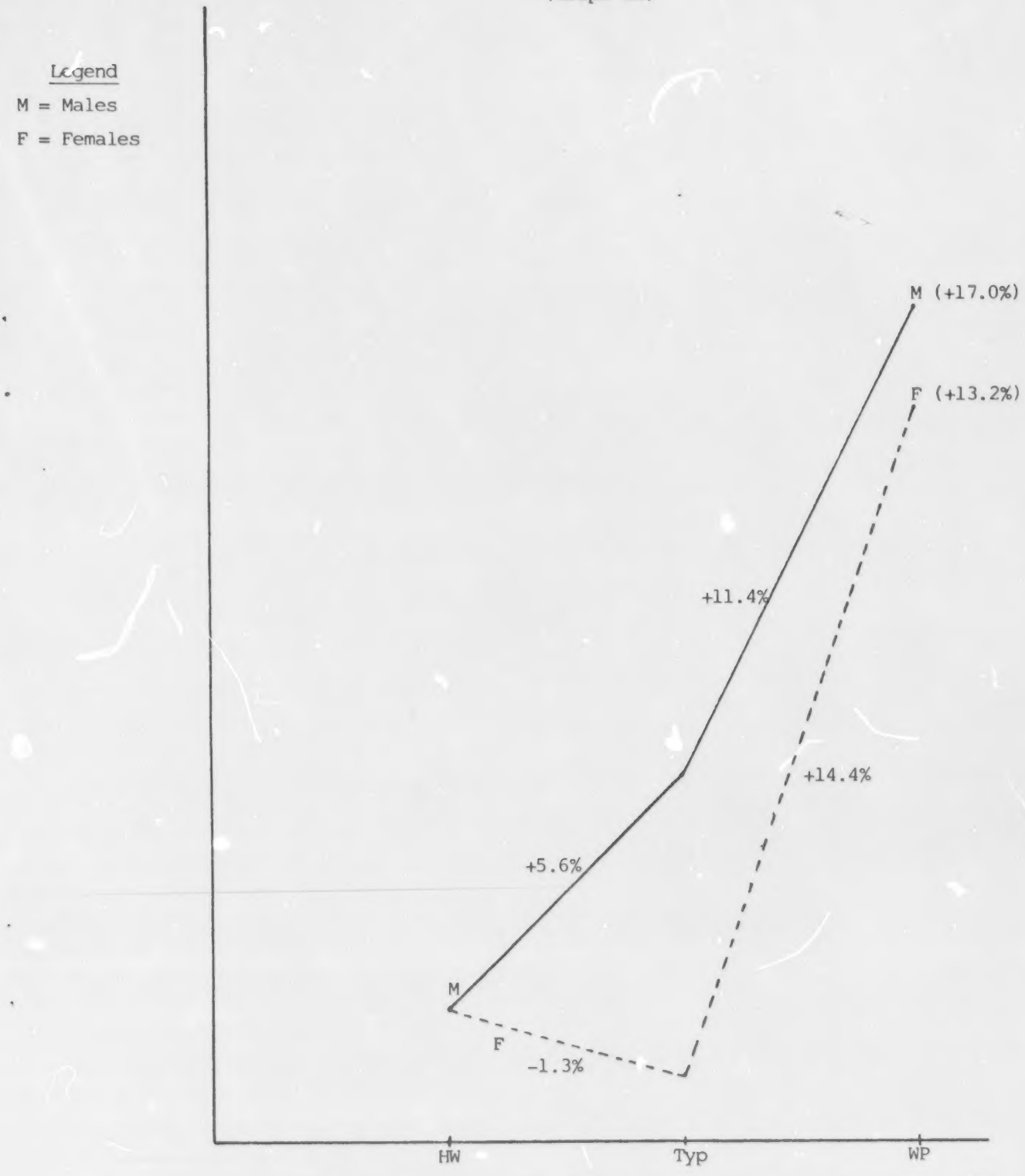


minimum position: with the right combination of techniques and conditions more impressive changes in quality than even this would almost assuredly take place.

Let me now review briefly the other combined scores and then return to a discussion of the creativity and writing skills results separately. First, the men were somewhat more successful (+6.9%) than the women in regard to the two evaluation scales when composing was performed on a typewriter, but this difference became relatively unimportant when composing was performed on the word processor: the women improved 14.4% and the men 11.4% over typing; the women improved 13.2% over handwriting and the men 17.0% (Graph XX). When using the word processor, the women improved their creativity most significantly and the men improved their writing skills most significantly. Clearly, the keyboard, whether it was attached to a typewriter or a word processor, was of some value to the men; the women, however, were about equally successful when writing by hand or on a typewriter, and their improvements in the quality of essays when composing on the word processor were quite probably the result of some aspect of the terminal other than the keyboard. It is interesting to speculate that the men found the mechanical operation of both the typewriter and the word processor to be liberating and beneficial, whereas the women found the visual aspect of the CRT on the word processor to enhance their writing process.

COMBINED SCORES: Sex Differences

(Graph XX)

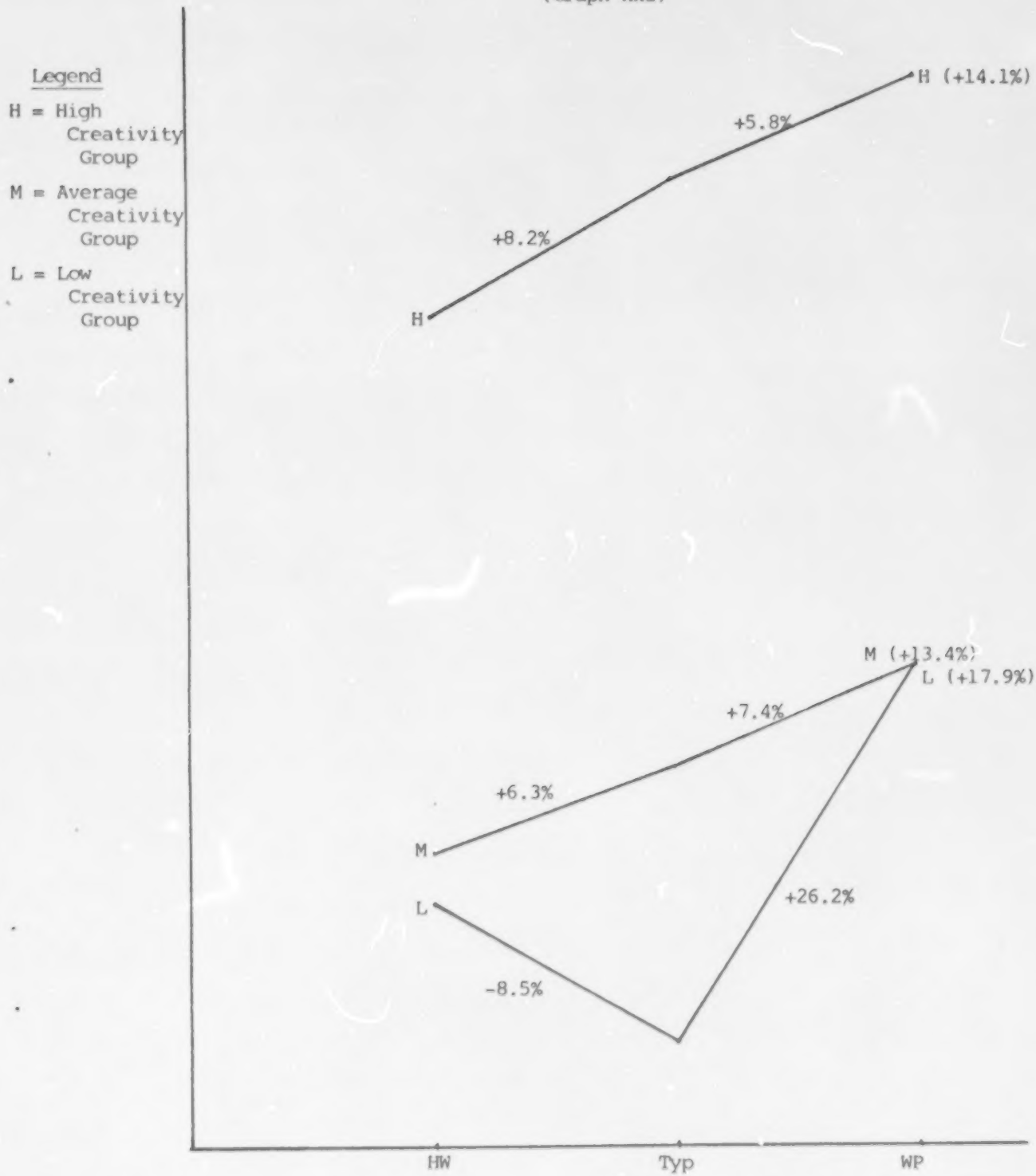


Both the Average and the High Creative Ability Groups improved their combined scores when they shifted from writing by hand to typing (M: +6.3%; H: +8.2%), but clearly for different reasons: the Average Creative Ability Group increased in creativity, whereas the High Creative Ability Group increased its scores in writing skills. The Low Creative Ability Group was considerably less successful with the typewriter than with writing by hand (-8.5%). However, all three ability groups improved their combined scores when composing was performed on the word processor rather than the typewriter (H: +5.8%; M: +7.4%; L: +26.2%)(Graph XXI). The rather remarkable difference in improvement between the High and Low Creative Ability Groups can be explained in part by recalling that the Low Creative Ability Group had a higher scoring ceiling than the High Creative Ability Group, thus quite probably exaggerating the distinction. However, the comparison of word processing scores to scores for handwriting suggests that the Low Creative Ability Group did, in fact, demonstrate the greatest affinity for writing on the word processor, even though the other two groups also improved significantly (L: +17.9%; M: +13.4%; H: +14.1%). What is, of course, most remarkable is the capacity of the word processor to permit the quality of the writing of the Low Creative Ability Group to catch up to or exceed the writing of the Average Creative Ability Group in all three modes. In other words, keyboarding (typing and word processing) seems to produce significant shifts in creativity and writing skills for the creatively average and superior student, whereas only word processing has such an effect for the relatively weak group.

The combined scores for the persuasive and expository essays were nearly identical. For example, in the typing vrs. handwriting comparison, the persuasive essays improved by +1.7% and the expository by +2.6%; in the word

COMBINED SCORES: Ability Groups

(Graph XXI)



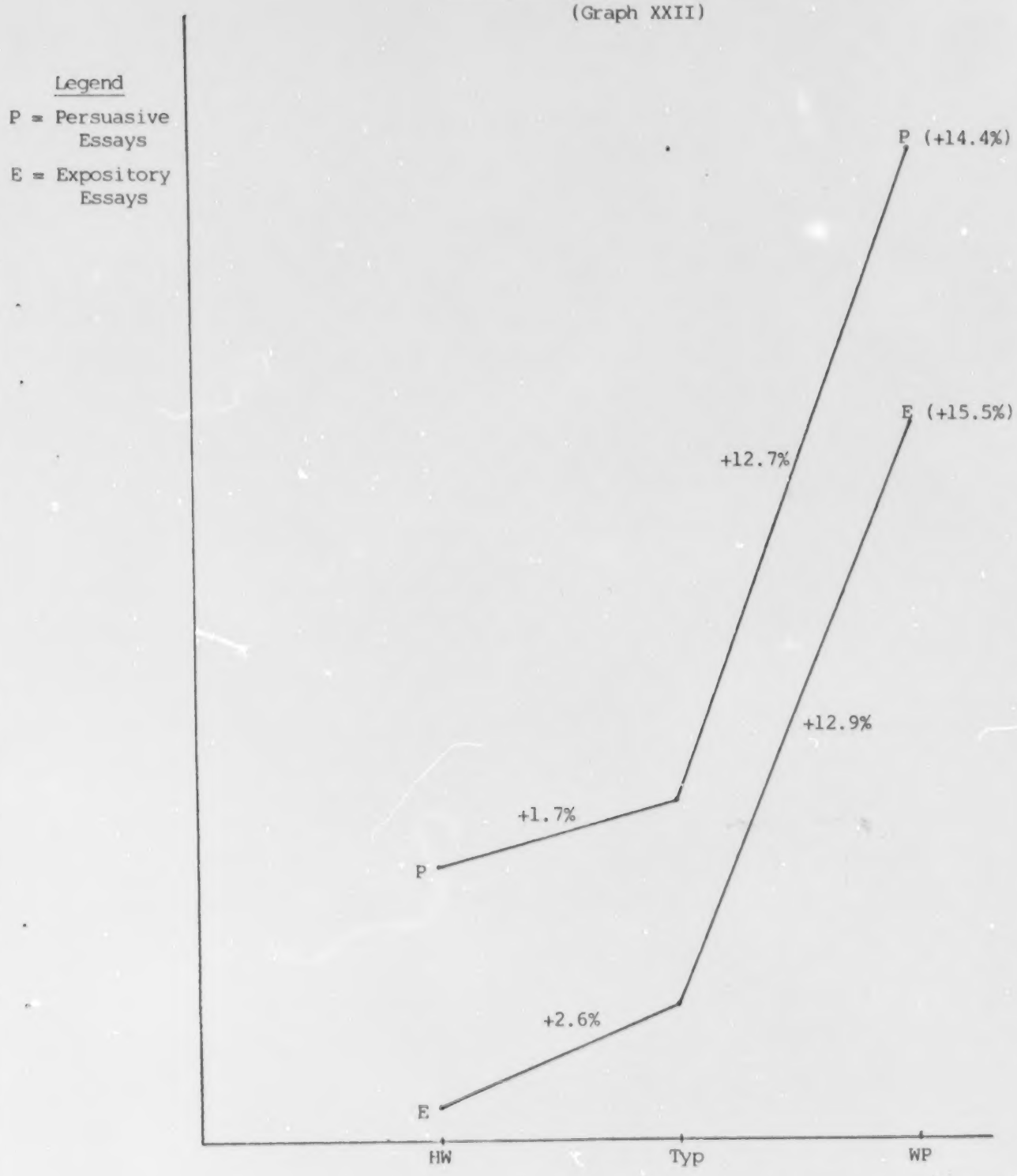
processing vrs. typing comparison, the persuasive essays improved by +12.7% and the expository by +12.9%; in the word processing vrs. handwriting comparison, the persuasive essays improved by +14.4% and the expository by +15.5%. These changes approximated the overall curve closely enough to suggest that in the larger picture rhetorical purpose was not a significant variable in relation to mode of composing (Graphs XXII and XXIII).

Whether there is a direct causal link between improved quality of written work and the use of a computer terminal must, of course, remain something of a moot point; studies with a greater number of subjects, that take place over a greater length of time, that require more essays to be written, and that control more of the variables will be needed even to approximate a definitive answer. As well, one might object that simply the novelty of composing at a terminal released such creative and cognitive potential, and, theoretically, as this novelty might wear away so, too, might the gains in writing ability. But the opposite is possible, also: greater familiarity with the word processor might in fact encourage even greater gains in composing powers by successively freeing up more and more of the writer's concentration from routine and trivial tasks. The answer to this question must, of course, wait until an appropriately longitudinal study is conducted.

A further objection might be that a fifteen percent increase in writing ability is simply not worth the investment in training time and in equipment. But, as I mentioned earlier, this is a fifteen percent increase that is achieved without the benefit of instruction in creativity and writing skills strategies. As well, I am fairly certain that improvements in writing ability cannot be mapped as linear functions, despite the limitations of our measuring

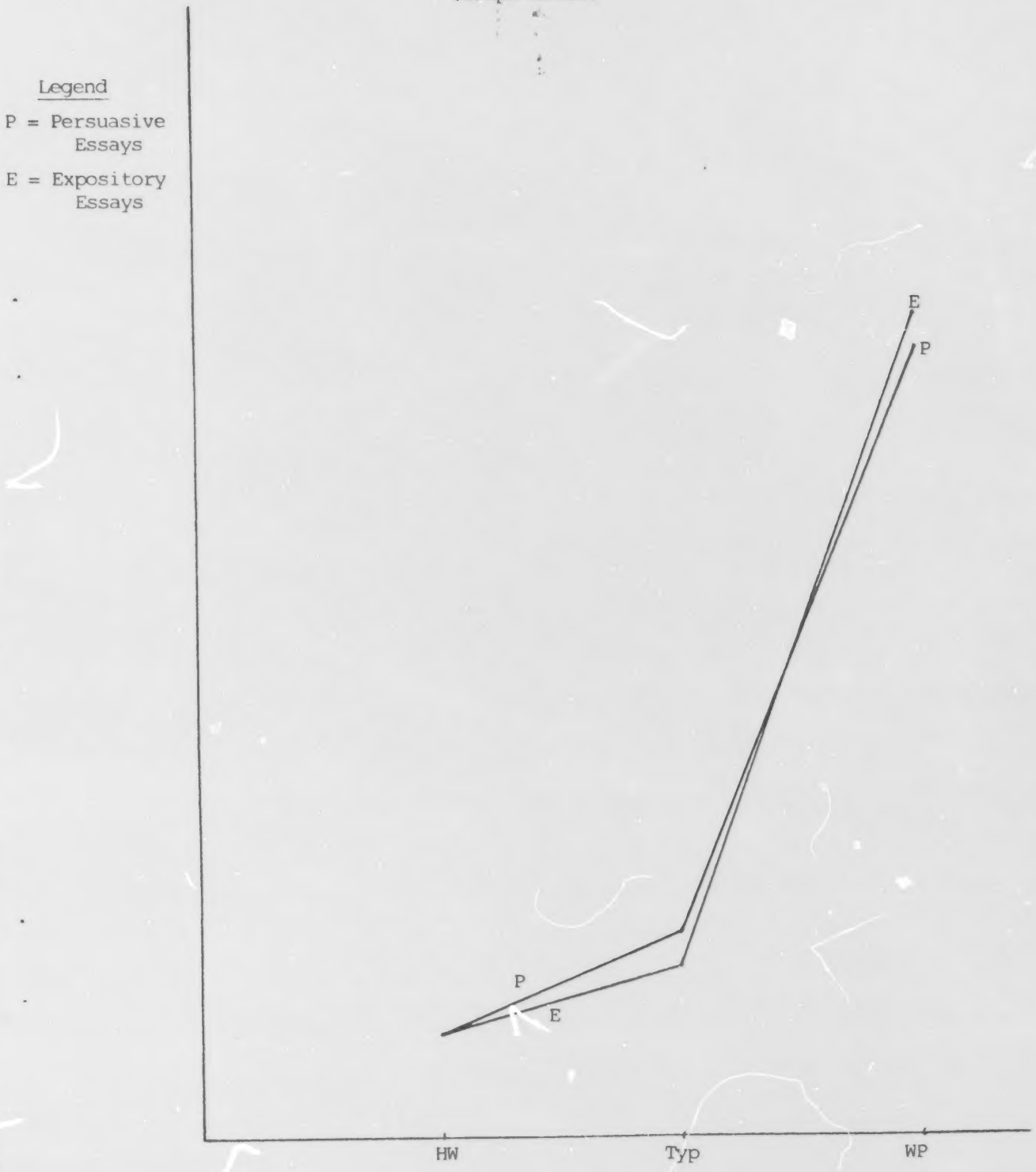
COMBINED SCORES: Rhetorical Mode

(Graph XXII)



COMBINED SCORES: Rhetorical Mode (Collapsed Origins)

(Graph XXIII)



instruments. For example, these students were probably working at nearly maximum creativity when they began the project, and creativity, like maximum aerobic fitness, is not a characteristic whose ceiling is easily raised. A fifteen percent increase on such an asymtotic curve is, therefore, quite significant. As well, since a six-point holistic scale is relatively coarse, a fifteen percent increase becomes fairly meaningful; a more refined scale, one with ten or twelve subdivisions, would, of course, record larger fluctuations, albeit at the expense of interrater reliability. Nevertheless, a fifteen percent increase on the scales used in this study represents a gain of a full point -- a gain that is frequently the best we can hope for from writing students during the course of an entire semester of composition study. Therefore, such a pilot project as this suggests that something about a CRT, keyboard and text editing capabilities allows writers to be more creative and more successful with writing skills than usual.

I have already mentioned the curious difference in composing patterns between the men and women. As well, some interesting deviations from the general picture occur when we look at the three ability groups. The strong creativity ability group, like the female subjects, improved its creativity most with the word processor. This group, in fact, followed the hypothetical linear progression of creativity increase from handwritten essays to typed essays to essays composed on a word processor. The creatively average group, surprisingly, was most creative on the typewriter, next most creative on the word processor, and least creative when writing by hand. The weak creative ability group, like the strong group, followed the hypothetical progression, only in this case little difference in creativity between essays written by

hand and on a typewriter emerged. Given that both the strong and weak creative ability groups follow the same curve, it seems reasonable to explain the variation by suggesting that the average group, being the most conservative of the three groups, was most creative on the familiar keyboard of the typewriter, and was less willing to take creative risks when using a new piece of equipment than the other two groups.

Although the persuasive essays were consistently assessed as being creatively superior to the expository essays, rhetorical purpose did not, as with the combined scores, appear to interact with any of the three modes of composing to produce significant aberrations in the creativity scores: both the persuasive and the expository essays followed the theoretical progression of being least creative when composed by hand, somewhat more creative when composed on a typewriter and most creative when composed on a word processor. However, two anomalous observations exist: 1. the difference in creativity between the persuasive essays composed on a typewriter and those composed on a word processor was quite small; 2. the difference in creativity between essays written by hand and those composed on a word processor was greater for expository than for persuasive essays. The first deviation may reflect an earlier possibility: for some subjects some of the time a change in creativity appears to derive from the use of a keyboard, and that in these instances, therefore, there is little difference between composing on a typewriter or on a word processor. The second anomaly is simply a "closing-the-gap" phenomenon: persuasive essays written by hand were evaluated as more creative than expository essays written by hand, but both rhetorical modes were evaluated as as almost equally creative when the writing was performed on a word processor.

For this to occur, the expository essays would have to improve by a percentage equal to the difference noted earlier (see Graphs XIII, XIV, XV, XVI). The real question is why should handwritten persuasive essays be rated as creatively superior to handwritten expository essays?

Matters are rather different when we look at writing skills. Essays produced on a typewriter generally possessed weaker writing skills than those written by hand or those composed on a word processor, whereas writing skills were best for essays produced on a word processor, although only slightly superior to those of handwritten essays. The explanation for the first part of this conclusion is fairly obvious: a typewriter, even a self-correcting model, possesses less revisional capability than either handwriting or word processing; since it is more difficult to alter text on a typewriter, an author is, therefore, more likely to be satisfied with an initial draft, and more likely to be conservative and cautious when composing this draft.

If writing skills are taken to mean only addition, deletion or alteration of words and phrases, the similarity between the scores for handwriting and word processing could be accounted for since the revision of surface structure problems is nearly the same for both modes of composing. However, the CUNY scale defines writing skills as much more than simply matters of correctness and diction. One can only guess, then, that the reason scores for writing skills on word processed essays were not higher is because the subjects were not sufficiently familiar with the revisional resources of the terminals to exploit them fully. Thus, their revisional strategies were frequently limited to what they were able to do by hand.

Even though the men were fairly creative when composing on typewriters, they received the lowest scores for both sexes for writing skills when composing in this mode. Clearly, for the men there is a trade-off between creativity and writing skills when using the typewriter. The women were, as I noted earlier, least creative and least successful with writing skills when employing the typewriter, and most successful when using the word processor.

The creatively superior students demonstrated their weakest writing skills when composing by hand and their strongest writing skills when composing on a word processor; however, these scores were not much greater than those for essays produced on a typewriter. For this ability group, then, it appears as though mechanical devices and/or the use of keyboards improves writing skills.

The creatively average and weak ability groups differentiated themselves on scores for writing skills primarily when they composed on the typewriter, the low creative ability group doing far worse than the average group. The lowest scores for both groups were awarded to essays composed by typing and the highest for essays composed on the word processor. However, the scores obtained for writing skills on essays composed by hand were not much lower than those obtained on essays composed on the word processor. The creatively average and weak ability groups do not appear, therefore, to have exploited very completely the revisional possibilities of the word processor.

Just as the persuasive essays were assessed to be superior to the expository essays in creativity, so also were they assessed to be superior in writing skills. Scores for writing skills for the persuasive essays were about the same whether the essays were composed by hand or on a typewriter, but were significantly improved for essays composed on a word processor. Scores for

writing skills for the expository essays were lowest when composing was done on a typewriter and about equally improved whether the composing was done by hand or on a word processor (the word processing scores were slightly higher). Although for both rhetorical modes word processing appears to produce better writing skills than either of the other two methods of composing, the pattern of increase in these scores is just the converse of that for creativity: whereas creativity scores rose from handwriting to typing to word processing most dramatically for the expository essays, writing skills scores rose most dramatically for the persuasive essays. If we assume that persuasive essays are naturally more creative than expository essays and that a student might, therefore, be more careful of writing skills in expository essays, then the symmetrical relationship just mentioned could be explained by inferring that a word processor frees up cognitive pathways ordinarily in use when writing by hand. thereby permitting the author to concentrate on matters usually neglected. In other words, a word processor permits one to be more than customarily creative when composing exposition without sacrificing concentration on writing skills, and permits one to focus more concertedly on writing skills when composing persuasion without sacrificing creativity.

One of the myths of education is that students whose mastery of the decorum of a discipline is quite poor might, at the same time, still be very creative, and that those who have mastered such protocol might not be particularly creative. Our hope, on the one hand, is for the proverbial "diamond in the rough", the sloppy genius; our fear, on the other hand, is of the competent drone, the mere technician. In composition classes we may set the student who has imaginative and challenging ideas but is unable to shape

these ideas into coherent sentences and paragraphs against the one who can compose a well-organized, correctly spelled, tidy five-paragraph essay but is unable to inject into it any sense of engagement, passin or depth. The correlation studies in the project suggest that for the most part such polarities are more the exception than the rule: the correlation between creativity and writing skills was, in fact, quite high. The creatively superior students generally possessed superior writing skills, the creatively average students average writing skills and the creatively weak students weak writing skills no matter what the mode of composing, their sex or the rhetorical purpose of the composition.

However, there were some exceptions to this observation: 1. The strongest correlations were for essays composed on a word processor, the next most strong for essays composed on a typewriter and the weakest correlations existed for essays composed by hand. Once again, this may suggest that for most students the word processor permits a more harmonious interplay between the right and left hemispheres, between invention and evaluation, than does writing by hand or typing. 2. Although the creatively superior student generally possessed superior writing skills, the creatively average and weak students frequently had quite similar writing skills levels. In fact, it is with the creatively weak students that the correlation pattern was sufficiently tenuous that one end of the polarity myth appears to have some validity: although this set of authors wrote essays assessed as the least creative of the three ability groups, in several instances their writing skills were judged to be of average or even superior quality. 3. Although the correlation between creativity and writing skills was for the most part maintained, there is some

indication that the writing skills of creatively superior students are not as strong as is their penchant for imagination, and that the writing skills of the creatively weak students are stronger than their fancies.

Several tests of validity, particularly distribution of subjects, suggest the experiment possessed a good measure of interrater reliability, even though the evaluators from the humanities and from the sciences disagreed over the scoring of essays in several instances. Generally speaking, the humanities evaluators awarded higher scores for creativity than did the science evaluators, but the two groups were in fairly close accord about scores for writing skills. However, the humanities evaluators were more critical of writing skills for the creatively weak group and the science evaluators were more critical of writing skills for the creatively average group. As well, the two groups disagreed most frequently about the writing skills of persuasive essays. These results suggest, then, that the evaluators from the humanities applied a somewhat broader intuitive definition of creativity than the science evaluators and tended to be more sensitive to writing skills problems in the less creative essays, but less critical of writing skills problems in the more creative or engaging essays. In other words, it would appear that the science evaluators were somewhat more doctrinaire or dogmatic in their application of the assessment criteria for creativity and writing skills than the humanities evaluators and the humanities evaluators somewhat more flexible in their willingness to amend the criteria according to their intuitions of the synergy between creativity and writing skills.

I think it is fair to conclude by saying that both the statistical assessment and the student evaluations lend some force to the suggestion that the eventual use of the word processor as an adjunct to the composition classroom may produce improvements in both the creativity and the writing skills of student essays, as well as in students' attitudes towards writing and writing instruction. Even if this is not always the case, computer assisted learning, including word processing, will free composition teachers to individualize their assistance more thoroughly. If the word processing terminal can offer even some of these benefits, its inclusion in the academy and in the English department should be considered seriously by those administrators concerned with both the quality of education and its cost effectiveness.

ENDNOTES

[1]Arthur C. Clarke, 2010: Odyssey Two (New York: Ballantine Books, 1982), p. 291.

[2]Peter A. McWilliams, The Word Processing Book (Los Angeles: Prelude Press, 1982), p. 133.

[3]See, for example, H. Burns, "Pandora's Chip: Concerns about Quality CAI" in Pipeline (1981), 6, 15-16, 19; Kamala Anandam, et al., "RSVP: Feedback Program for Individualized Analysis of Writing," ERIC title ED 1919 511 (1979); and Helen Schwartz, "The Use of Computers in Teaching English", Presentation to the Michigan English Association, Dearborn, 1981. This, of course, is only a brief sampling of the articles currently available.

[4]A recent issue of College Composition and Communication (Vol. 34, No. 2; May 1983) presented a cluster of articles pertaining to the application of word processors to the composition classroom: Colette A. Daiute, "The Computer as Stylus and Audience," pp. 134-45; John C. Bean, "Computerized Word-Processing as an Aid to Revision," pp. 146-48; Richard M. Collier, "The Word Processor and Revision Strategies," pp. 149-55.

[5]William Zinsser, Writing with a Word Processor (New York: Harper and Row, 1983), p. 107.

[6]Zinsser, p. 112.

[7]Lester Faigley and Thomas P. Miller, "What We Learn from Writing on the Job," College English, Vol. 44, No. 6 (October, 1982), p. 561.

[8]Zinsser, p. 111.

[9]Damon Knight, Creating Short Fiction (Cincinnati, Ohio: Writer's Digest Books, 1981), p. 197.

[10]Thomas L. Franke, "Computers and Writing Instruction: Issues for Policymakers," Pipeline (Spring, 1982), p. 61.

[11]Franke, p. 61.

[12]Nick Eastmond, "High Technology and Faculty Effectiveness: An Update," Innovation Abstracts, Vol. 5, No. 19 (1983), p. 1.

[13]Edward P. J. Corbett, "The Demands for and of Literacy," The English Quarterly, Vol. 15, No. 3 (October, 1982), p. 11.

[14]Ruth Mitchell, in a review of Well-Bound Words: A Rhetoric by John J. Ruszkiewicz in College Composition and Communication, Vol. 34, No. 2 (May, 1983), p. 237. See also the conclusion to my article cited above in endnote four.

[15]"Word Processors: Do They Help Writers?" Coda: Poets & Writers Newsletter, Vol. 10, No. 3 (February/March, 1983), p. 10.

[16]Colette A. Daiute, "The Computer as Stylus", College Composition and Communication, Vol. 34, No. 2 (May, 1983), p. 134.

[17]Daiute, p. 136.

[18]Daiute, p. 142.

[19]Daiute, p. 143.

[20]Daiute, p. 144.

[21]Daiute, p. 135.

[22]Very early in the discussion of the effect of the computer in the Humanities Ellen W. Nold suggested that "computer programs can call forth creativity because they provide a fertile environment: privacy of communication and time." See Ellen W. Nold, "Fear and Trembling: The Humanist Approaches the Computer", College Composition and Communication, Vol. 26 (October 1975), p. 271.

[23]Michael Holzman, "Scientism and Sentence-Combining," College Composition and Communication, Vol. 34, No. 1 (February, 1983), p. 73.

[24]Holzman, p. 75.

[25]Robert J. Connors, "Composition Studies and Science," College English, Vol. 45, No. 1 (January, 1983), p. 18.

[26]Carol Berkenkotter, "Decisions and Revisions: The Planning Strategies of a Publishing Writer," College Composition and Communication, Vol. 34, No. 2 (May, 1983), p. 167.

[27]Professor Connors is not at all as sweeping in his scepticism about the statistical approach as Holzman: ". . .I distrust our unexamined tendency toward postivism, but there must be room in composition studies for statistical or quantitative analyses or for science-based experimentation. We cannot cut our discipline off from verificable knowledge" (Connors, p. 19).

[28]Charles R. Cooper and Lee Odell (eds.), Research on Composing: Points of Departure (Urbana, Illinois: National Council of Teachers of English, 1978), p. xiv.

APPENDIX A

The Creativity Scale

I. Very Low Creativity

The scope of concerns in the essay is trivial and the writer does not deal with matters of much interest or moment; the author has a few distinct ideas and is unable to discern the core of a problem worth exploring or communicating; the prose is unnecessarily repetitious.

The writing is vague and general: there is very little, if any, depth of investigation, exploration or discovery; the author is unable to move appropriately from the general/abstract to the specific/concrete or vice versa. He or she fails to perceive larger aspects of the problem or topic, to bring supporting evidence to bear upon debatable propositions, or to deal with questions arising from what has been written; statement of opinion or belief substitutes for critical examination. The writer does not deal with significant implications or ambiguities in his or her statements.

The writing generally lacks insight, originality or novelty; the author uses cliches, sterotypes, and conventional associations, relationships, style and language; he or she follows precept and prescription (if at all) in conventional ways, particularly in regard to ideas and thinking. There is no sense of skepticism, doubt, or challenge; ideas and style are unvaryingly conservative and nothing daring or risky appears in the essay.

The prose lacks all sense of energy, enthusiasm, engagement, commitment or delight. There is little evidence of emphasis or feeling, although there may be a good deal of exhortation. The writing may have an apologetic quality to it.

The essay lacks humor, confidence and aesthetic sensitivity.

II. Low Creativity

The scope of concerns (in breadth or depth) is somewhat larger than in I and somewhat smaller than in III, but it is, in any case, not very great; occasionally, but only rarely, do ideas of modest interest or value appear, and they flounder in a morass of banalities and repetition.

The writing is vague and general, even though there may be attempts to explore an idea over an extent greater than two sentences; there is an infrequent use of supporting examples to interrupt generalities; the occasional half-hearted attempt to draw a conclusion from a sequence of (usually narrative) details may appear. Implication and ambiguity may be recognized, but are dismissed out-of-hand or by cliches. Nearly all forays into the skeptical or movements toward new insights are truncated.

Occasionally a phrase or an image or even a sentence may contain the stuff of a good idea, but it remains the traditional "diamond in the rough"; this gleam of insight or novelty is buried under layers of cliches, prejudices, unsupported abstractions, and unexamined biases; style and language are simple, lack readability and are immature. The language is charaterized also by the use of "code" words (words which may be rich in meaning for the author, but lack significance for the reader because they are not explained explicitly or by context).

The author is at least willing to attempt the task of writing the essay, and to this extent there is some sense of energy and commitment; but it is mostly a dull plod with little delight or enthusiasm, despite the occasional exclamation or deliberate use of informal diction.

The prose may be hesitant and unsure or inappropriately arrogant and assertive; if there is humor, it is off-color, stale, or misplaced.

III. Low Average Creativity

The scope of concerns (in breadth or depth) is about what one would expect for an entering student at a community college; some ideas are at least potentially interesting and valuable, but the majority are vague, repetitious and trite.

An idea may be examined throughout a (usually brief) paragraph, and up to half of that paragraph may be examples, supporting detail, explanation or evidence (frequently, as in IV, brief, elliptical or allusive). In essence, the text possesses some rudimentary sense of systematic thinking (which may be inductive, deductive or enthymemic) and focuses on concerns that are, at least for this writer, authentic. The author attempts in a naive and generally unsuccessful way to incorporate a discussion of ambiguities and implications discovered in the course of writing into the evolution of the text. Figurative language rarely rises above the cliche.

The essay may have some ideas of genuine, compelling interest, but not many; although more frequent than in II, they are still surrounded by cliche, unsupported opinion and conventional wisdom. Style may include a few complex or parallel structures, but is generally obscure, possibly convoluted, egocentric and "writer-based." Whatever insights there are remain isolated and unconnected to each other.

The author may exhibit a fair amount of energy and personal interest in his or her text, but it is inchoate and may lapse easily into mechanical dullness.

The prose may be relatively confident, although such confidence is probably not justified; humor may occasionally be effective, even though it is usually self-conscious. There is a gleam, but only a gleam, of aesthetic sensitivity in the writing.

IV. High Average Creativity

The scope of concerns (in breadth or depth) is of moderate extent and displays what could be called an incipiently inquiring mind. Although there will be detours into the vague, sterotyped and just plain dull, by and large the majority (not always a large majority) of ideas will be of some interest and of some importance.

An idea may be examined in a paragraph of some substantial length (or through several shorter, but related paragraphs). The author's thinking will appear to be systematic, but displays several, but not always obvious, failures of logic or omissions of steps necessary for real rigor. Major generalizations are explained or supported with examples (frequently brief, elliptical or allusive), and digressions may be more matters of curiosity for the reader than annoyance. It is in such digressions that we sometimes find an examination of implications or ambiguities. Evidence of some degree of imagination is provided by the occasional rich phrase or colorful figure of speech; these, along with attempts at making unusual connections are more to be praised in their conception than in their formulation, which is often awkward or incomplete.

Although, as mentioned earlier, there are a fair number of ideas of interest in the essay, the narrative or expository list and chains of private associations may substitute for more original organizational plans. This writing has less of the cliche and stereotype than in III, but when these figures are used they obtrude in the prose quite uncomfortably. Style has a fluidity and vocabulary somewhat above the mediocre. The author is more willing to present than challenge conventional ideas, and a loud tone of voice often substitutes for real daring. However, there is a clear attempt to give the essay as a whole some kind of shape.

The writing is about equally mixed between vigor and engagement, on the one hand, and simply "skating" through filler material, on the other. However, there is good evidence that the author is not simply writing out a canned package of information, but has from time to time made a discovery during the course of writing that is genuinely intriguing and even startling (at least to the writer). Nevertheless, delight and strong feeling are frequently muted.

Confidence and tentativeness may be fairly balanced; the author may risk humor from time to time. Both style and content suggest at least a capacity for aesthetic sensitivity.

V. High Creativity

The essay includes a large (in breadth or depth) scope of concerns; there may be occasional digressions, but they are themselves usually of some interest. The ideas expressed are frequently intriguing and often suggest new ways of looking at old concerns.

The writing is generally precise and accurate, despite occasional lapses. Ideas are discussed at some length, although there may at times be a sense of incompleteness. The general and specific, the abstract and concrete are usually kept in balance even though the author tends to get caught up in one or the other level of discourse; implication and ambiguity are anticipated and examined, occasionally in a cursory fashion. Surprising and unusual distinctions and connections are the rule as in VI, but they are not as powerful, apt, eccentric or bizarre. Metaphor, analogy and the like are exciting when used, but they appear less frequently than they might and are sometimes imperfect.

The writing is quite imaginative, shows a good deal of insight and is often unique, original and novel. There is little of the cliche or stereotype in thought or expression, although they may not be entirely absent. The author is clearly willing to explore ideas in a daring fashion and to reach his or her own conclusions; occasionally, however, this new vision (or way of seeing things) instead of challenging conventional wisdom, confirms it (at least in the author's mind).

The writing is vigorous and attacks the topic enthusiastically, despite the occasional bland patch. Exploring may, however, be more important than communicating. Delight and strong feeling may be evident, but they may also dominate good sense. Style is reasonably individual, even (appropriately) eccentric.

Humor and aesthetic sensitivity are evident, but may be immature.

VI. Very High Creativity

The essay includes a large (in breadth or depth) and frequently -- but not always -- unified scope of concerns: it consistently focuses on ideas of interest and significance and has defined (explicitly or implicitly) a serious matter worthy of exploration or sometimes a light matter to be viewed in a unique fashion. Repetition is used only for emphasis.

The writing is always precise and accurate even when dealing with large or general concerns. Discussion of ideas is of appropriate length, and modulations between the general and the specific and between the abstract and the concrete are often startlingly apt; main ideas are intriguing, often striking, and support, evidence, explanation, example and all illustrative materials are original, colorful and frequently of an unexpected nature. The author anticipates and examines significant implications and ambiguities; rarely are loose ends in the text except to achieve a desired effect. The author frequently brings to light surprising and unusual connections or finds distinctions where none were before apparent; metaphor, analogy and other figures of speech are imaginative and used with skill.

The writing is highly imaginative, shows much insight and is frequently unique, original and novel; cliches, stereotypes and all manner of conventional thought and style are eschewed except for deliberate effects; the author is daring in his/her thinking and willingly challenges and doubts conventional ideas.

The writing is charged throughout with energy and enthusiasm; the author is clearly involved in and committed to the task of exploring and communicating his/her ideas; the writing communicates delight, effervescence and strong feeling; style has an individual flair to it.

The writing is successfully humorous, when humor is appropriate, and displays both confidence and aesthetic sensitivity.

APPENDIX B

CUNNY Scale

The City University of New York Writing Skills Assessment

Test Evaluation Scale (CUNY)

I. Very Low Competence

The essay suffers from general incoherence and has no discernible pattern of organization. It displays a high frequency of error in the regular features of standard written English. Lapses in punctuation, spelling, and grammar often frustrate the reader. Or, the essay is so brief that any reasonably accurate judgment of the writer's competence is impossible.

II. Low Competence

The essay begins with a response to the topic but does not develop that response. Ideas are repeated frequently, or are presented randomly, or both. The writer uses informal language frequently and does little more than record conversational speech. Words are often misused, and vocabulary is limited. Syntax is often tangled and is not sufficiently stable to ensure reasonable clarity of expression. Errors in grammar, punctuation, and spelling occur often.

III. Low Average Competence

The essay provides a response to the topic but generally has no overall pattern of organization. Ideas are often repeated or undeveloped, although occasionally a paragraph within the essay does have some structure. The writer uses informal language occasionally and records conversational speech when appropriate written prose is needed. Vocabulary often is limited. The writer generally does not signal relationships within and between paragraphs. Syntax is often rudimentary and lacking in variety. The essay has recurrent grammatical problems, or because of an extremely narrow range of syntactical choices, only occasional grammatical problems appear. The writer does not demonstrate a firm understanding of the boundaries of the sentence. The writer occasionally misspells common words of the language.

IV. High Average Competence

The essay shows a basic understanding of the demands of essay organization, although there might be occasional digressions. The development of ideas is sometimes incomplete or rudimentary, but a basic logical structure can be discerned. Vocabulary generally is appropriate for the essay topic but at times is oversimplified. Sentences reflect a sufficient command of standard written English to ensure reasonable clarity of expression. Common forms of agreement and grammatical inflection are usually, although not always, correct. The writer generally demonstrates through punctuation an understanding of the boundaries of the sentence. The writer spells common words, except perhaps the so-called "demons", with a reasonable degree of accuracy.

V. High Competence

The essay provides an organized response to the topic. The ideas are expressed in clear language most of the time. The writer develops ideas and generally signals relationships within and between paragraphs. The writer uses vocabulary that is appropriate for the essay topic and avoids oversimplifications or distortions. Sentences generally are correct grammatically, although some errors may be present when sentence structure is particularly complex. With few exceptions, grammar, punctuation, and spelling are correct.

VI. Very High Competence

The essay provides a well-organized response to the topic and maintains a central focus. The ideas are expressed in appropriate language. A sense of pattern of development is present from beginning to end. The writer supports assertions with explanation or illustration, and the vocabulary is well suited to the context. Sentences reflect a command of syntax within the ordinary range of standard written English. Grammar, punctuation, and spelling are almost always correct.

APPENDIX C

Table of Results

RESULTS

FIGURE I:

	CREATIVITY SCORES			WRITING SKILLS SCORES			COMBINED SCORES		
	Typed vrs. Handwritten	Word Processed vrs. Typed	Word Processed vrs. Handwritten	Typed vrs. Hand written	Word Processed vrs. Typed	Word Processed vrs. Handwritten	Typed vrs. Hand written	Word Processed vrs. Typed	Word Processed vrs. Handwritten
All Subjects	+ 4.7%	+ 5.6%	+10.5%	- 2.6%	+ 7.2%	+ 4.5%	+ 2.1%	+12.8%	+15.0%
Male Subjects	+ 8.8%	+ 2.2%	+11.0%	- 3.2%	+ 9.2%	+ 6.0%	+ 5.6%	+11.4%	+17.0%
Female Subjects	+ 0.75%	+ 9.0%	+ 9.8%	- 2.0%	+ 5.4%	+ 3.4%	- 1.3%	+14.4%	+13.2%
Low Creativity Group	+ 2.7%	+11.7%	+14.5%	-11.2%	+14.5%	+ 3.4%	- 8.5%	+26.2%	+17.9%
Average Creativity Group	+ 9.8%	- 1.1%	+ 8.6%	- 3.5%	+ 8.5%	+ 4.8%	+ 6.3%	+ 7.4%	+13.4%
High Creativity Group	+ 2.0%	+ 6.8%	+ 8.9%	+ 6.2%	- 1.0%	+ 5.2%	+ 3.2%	+ 5.8%	+14.1%
Persuasive Essays	+ 4.6%	+ 3.6%	+ 8.3%	- 2.9%	+ 9.1%	+ 6.1%	+ 1.7%	+12.7%	+14.4%
Expository Essays	+ 4.8%	+ 7.6%	+12.5%	- 2.2%	+ 5.3%	+ 3.0%	+ 2.6%	+12.9%	+15.5%

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